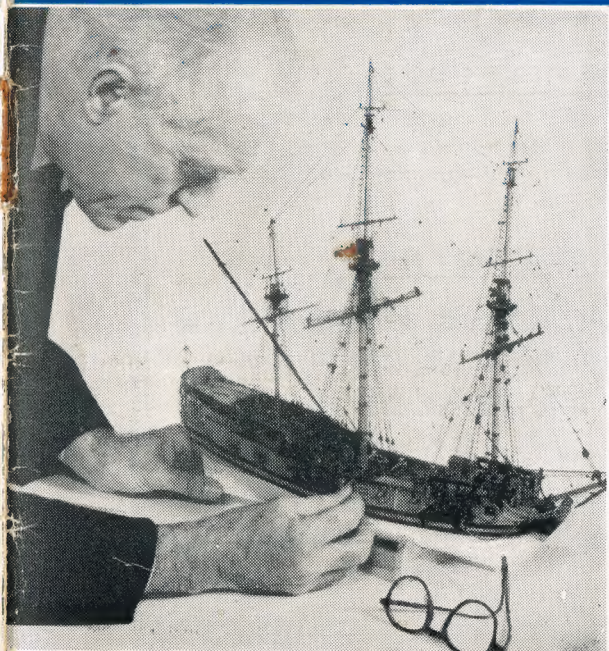
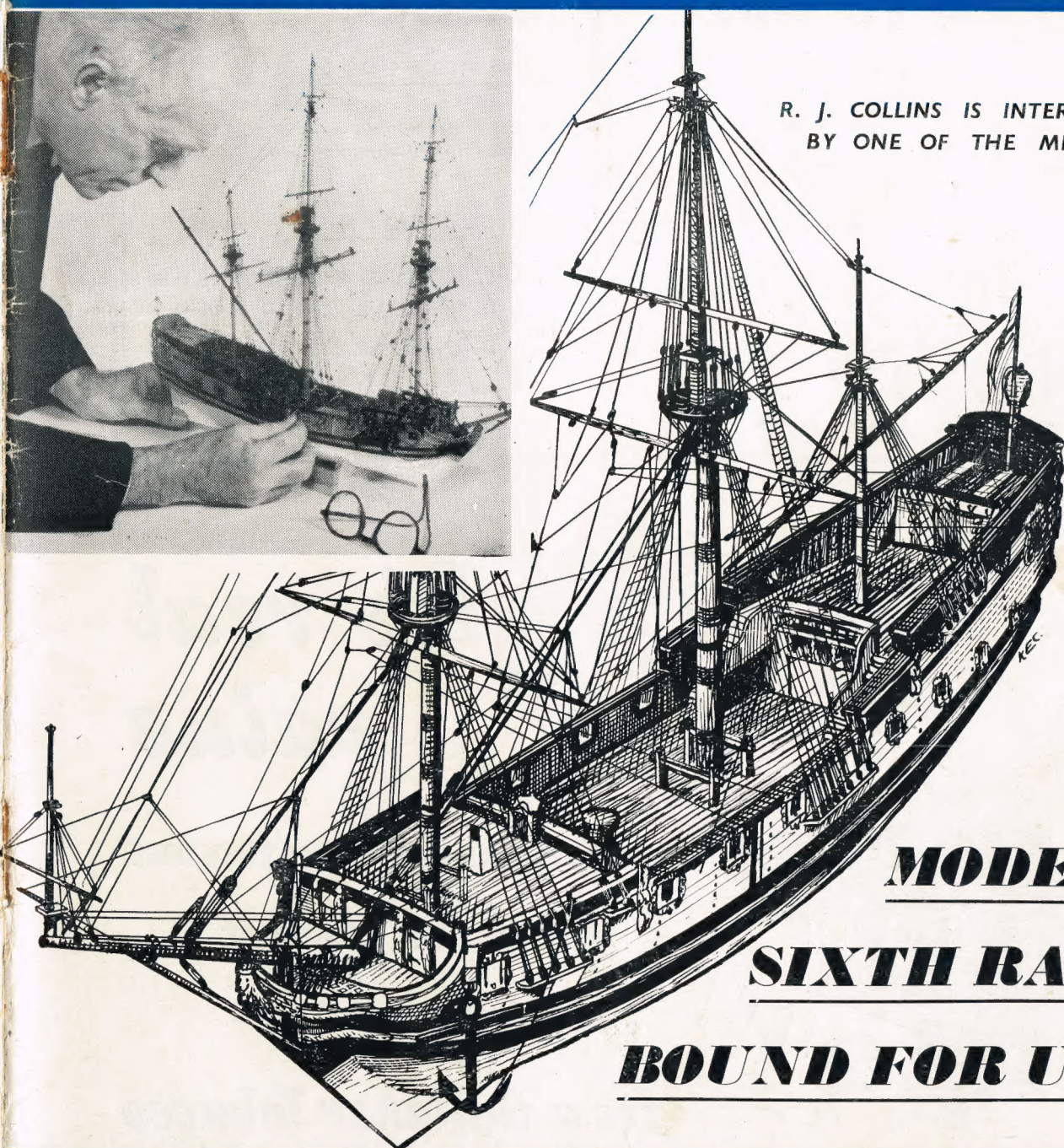


# ***Model Engineer***

**THE MAGAZINE FOR THE MECHANICALLY MINDED**



R. J. COLLINS IS INTERVIEWED  
BY ONE OF THE ME STAFF



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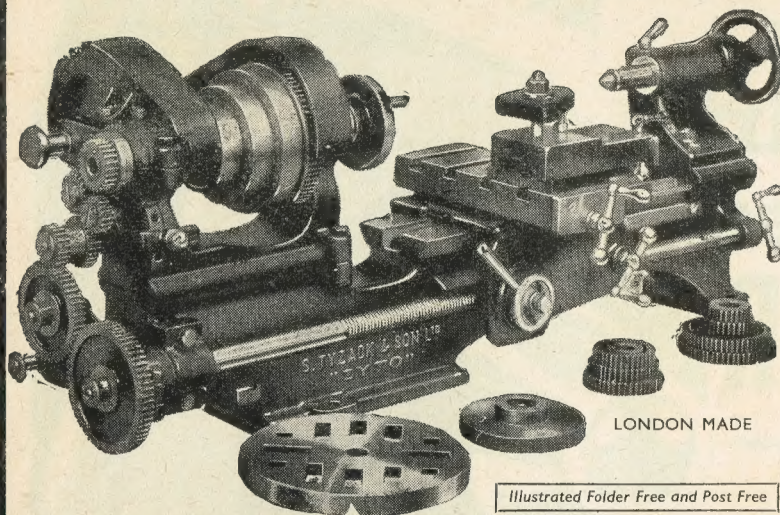
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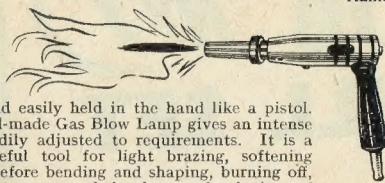
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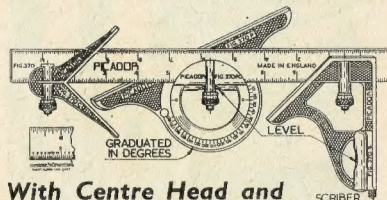
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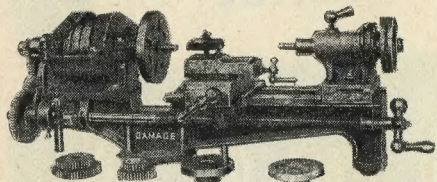
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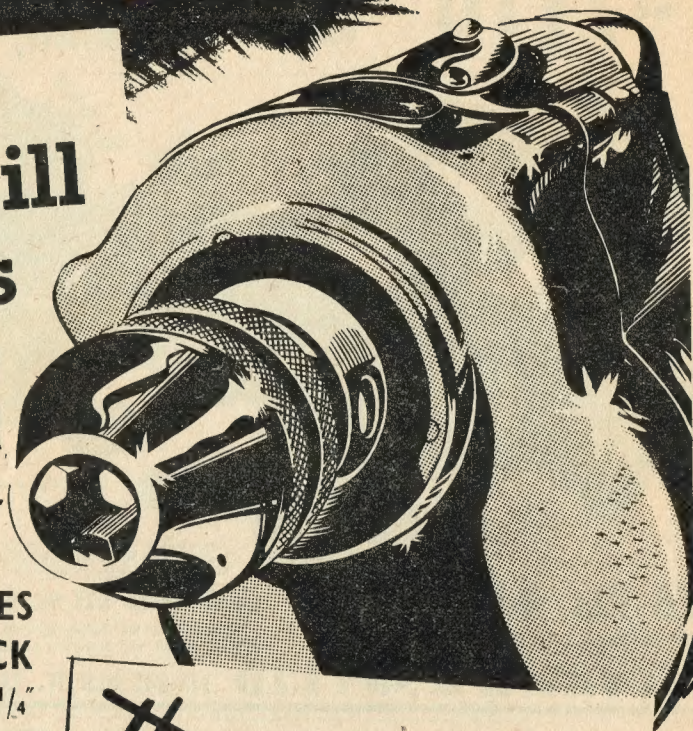
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# Model Engineer

ONE SHILLING 7 NOVEMBER 1957 VOL. 117 NO 2946

Published every Thursday Subscription 65s. (USA and Canada \$9.25) post free

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## Next week

**Theme for a workshop:** A suggested method for laying out the machinery and stores in a home workshop

**Cylinder lubrication**

**National rally**

**Model power boat propulsion—2**

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The Editor is pleased to consider contributions for publication in MODEL ENGINEER. Manuscripts should be accompanied by photographs and/or drawings and should have a stamped addressed envelope for their return if unsuitable. None of the contents of MODEL ENGINEER may be reproduced without written permission. All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W1.



A WEEKLY COMMENTARY BY VULCAN

I WAS interested to receive a letter this week from a reader who is employed in the research department of an aircraft firm. He was inquiring about a set of lines for a modern ocean going steam tug from which he intends making a model.

He mentions a facet of model engineering which is sometimes lost sight of—that it provides a complete contrast from the everyday jobs of craftsmen and engineers of all types. There are many professional model makers on call in his research department. "Needless to say," writes my correspondent, "none of them is interested in model aircraft. With high and low speed tunnel work we see and hear enough of model aircraft."

Well, a steam tug should provide a very satisfactory contrast to the noise of model aircraft and I wish the project all success.

### By numbers

IF you ever visit the home workshop of S. A. Walter, of Wembley, and quote any number up to 300 you are likely to be handed a tin of 8 BA bolts or a box of Swiss files.

For Mr Walter has evolved a numerical system of filing and classifying his stock, which he demonstrated very effectively when I visited him recently.

Most model engineers label their stock containers with the name of the article stored therein; Walter, instead,

gives each tin a number. To locate an item he merely refers to two lists, kept within easy eye-range, and reads off the appropriate number to that item.

To make the system work smoothly he has identical tins which stack uniformly, and he paints the numbers large and legibly.

### Advantages

This method seems to me to possess two distinct advantages. First, when a change of contents is made there is no alteration needed to the tin; it retains its number, and the alteration is done on the reference list.

Secondly, when a tin is missed its recovery is made more easy because its number, by omission from the sequence, is known and, therefore, its contents. One has only to recall where those particular items were last used to direct one's search to the most likely corner of the workshop.

I wonder what other systems model engineers employ to keep track of their stock? None, I hope, like the one used by a one-time colleague whose method of clearing a desk was to open the drawer and sweep everything into it.

### Facts and figures

THE 1957 edition of an interesting little booklet *Facts and figures about British Railways* has just been issued. It refers, of course, to the year's working for 1956 and it presents

## Smoke Rings . . .

a sombre financial position. The steady and substantial increases in costs were not matched by increases in receipts and that portion of the book should have been printed in red ink.

Apart from finances, however, the story it tells is a fascinating one—a broad canvas of the many activities of British Railways. Copies of the booklet are available to the public free on application to British Transport Commission, 222 Marylebone Road, London, NW1. Readers who apply for copies should mention MODEL ENGINEER.

### Commander Barker

**B**UILDER of a series of models which illustrated the history of marine engines, Commander William Theodore Barker, MBE, RN(Ret.), died at his home in London on October 10. He was aged 72.

The models were superb examples of craftsmanship and attracted a great deal of attention. When the Duke of Edinburgh attended the 50th anniversary show of the Society of Model and Experimental Engineers he expressed much interest in the series.

Although failing health prevented Commander Barker from making his customary attendance at this year's

ME Exhibition two of his models were on show at the SMEE stand.

It would not be an exaggeration to say that Commander Barker's models were among the finest examples of their kind in the world; his influence in ship modelling will be sadly missed.

### The new railcars

**M**AKING the short railway journey the other weekend from Stratford-upon-Avon to Leamington Spa (Western Region) I was very interested to note the use of one of the new BR three-car diesel sets, the previous train used on this service being either an ex-GWR oil-engined streamlined railcar (sometimes with trailer coach) or a standard 61XX 2-6-2T with two or three 57 ft suburban coaches.

My first reaction to the new set was that visibility for all passengers was exceptionally good, in addition to which a good view straight ahead was available from many of the seats.

Railway enthusiasts should make a point of sampling the front seats. Seeing the track rushing up to me and watching particularly the approach of a high-speed train were rewarding experiences.

On the other hand, the quality of the interior furnishings leaves something to be desired; the seats, of tubular construction, are rather lightly made and covered with leathercloth. I cannot see the interior standing up to the years of hard wear that some of the older rolling stock nobly withstood.

From a mechanical point of view, acceleration up to about 20 m.p.h.

### Cover picture

*R. J. Collins with his model of a Sixth Rater, which has been sold to a private collection in New York. See story on page 636.*

seems rather slow, but beyond that speed it is very satisfactory. There is some engine noise and vibration, but I am glad to say I did not notice that unpleasant smell of raw diesel oil associated with the earlier cars.

### Needle bearings

**O**VER in the USA needle roller bearings are now being used to quite a large extent in model engineering. Among other applications, these bearings are being used in locomotive axles, valve gears, etc.

The term "needle bearing" means a bearing in which there is no cage or separator retaining the individual rollers. The elimination of the cage increases the effective bearing contact area and the load carrying capacity. The shaft on which this type of bearing operates must, of course, have a hardened surface.

In general, bearings used for rotating motion and for higher speeds employ a small number of large diameter rollers, while bearings subjected to oscillating motion, and higher loads, employ a large number of small diameter rollers.

A brochure issued by a well-known British and American manufacturer shows that these needle bearings are available in a large variety of sizes and types, the smallest being of  $\frac{1}{8}$  in. bore. I think they would be ideal for locomotive axles, valve gear bearings, Walschaert's gear return cranks and so forth. Friction in such parts would be considerably reduced as compared with the usual plain bearings.

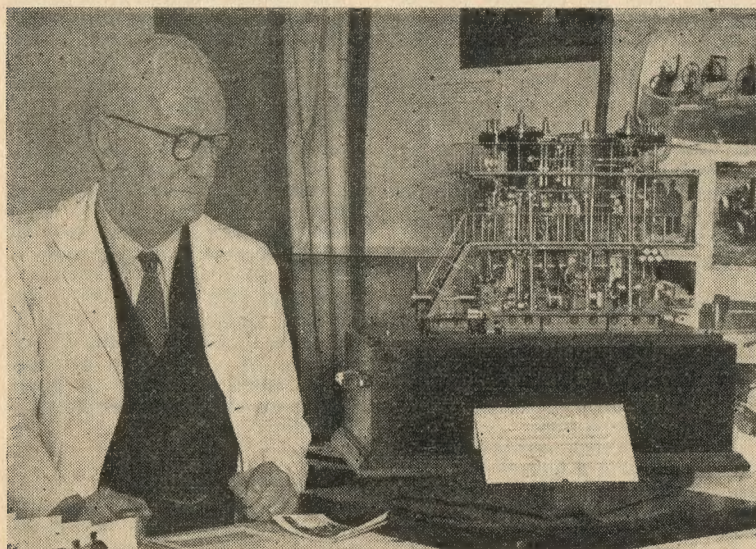
### Trophy conditions

**I** AM afraid I slipped up in referring to conditions for the Duke of Edinburgh Trophy at the ME Exhibition [10 October 1957]. I said then that entries were open to winners of bronze medals.

That is not so. The actual wording of the clause is as follows:

Any piece of model engineering work shall be eligible for the championship award three years after it has been awarded, at the Model Engineer Exhibition, a championship cup, gold or silver medal or one of the cups donated by "Friends of the Exhibition."

It is important that these conditions should not in any way be confused and I hasten to put them right. Bronze medal winners are not eligible.



Commander W. T. Barker with his triple expansion marine engine which was displayed on the SMEE stand at the 1956 ME Exhibition

# A 4-4-0 TENDER ENGINE FOR BEGINNERS

By MARTIN EVANS

Care with the cylinders is especially emphasised in this second article on the construction of a spirit-fired locomotive

*The ME  
gauge 1  
steam  
locomotive*

**I**N my first article I dealt with the mainframes, axleboxes, wheels and axles, and the bogie.

Coming now to the cylinders, which are, one may say, the "heart" of the model, it must be remembered that in gauge 1 you have no big reserve of steam to play with, as in a  $3\frac{1}{2}$  in. or 5 in. gauge model. So care must be taken to see that no steam is wasted. Certain it is that extra trouble taken at this stage will be amply repayed later on.

There are half a dozen different ways of tackling the cylinders, so take your choice! My method was to hold the cylinder block in the 4-jaw and take a cut right across each end to bring it to correct length.

If you adopt this method, it is most important to ensure that the block is held true in the chuck. This can be checked by applying a medium to large square to the edge of the block and "sighting" the blade against the lathe bed, or—and this is a more accurate way—traverse the cross slide right across the face of the block and check with a feeler gauge. When you have one end machined this end can be held firmly against the chuck body while tightening up.

Another method for machining the ends is to clamp the block on a vertical slide mounted on the lathe boring table and traverse the whole thing across a large end mill held in the chuck. This is a good way, for after the second face has been machined, you are all set to begin drilling out the bores,

Start the bores with a centre drill and open out gradually to  $27/64$  in., reducing the mandrel speed as you go up with the drills.

A  $\frac{7}{16}$  in. parallel reamer could now be used to finish the bores, but it is really asking rather a lot to expect the reamer to remove  $1/64$  in. A better way would be to follow the  $27/64$  in. drill with a small boring tool which may be held in the 4-jaw. This can be used to bring the bore up to about 0.005 in. under the  $\frac{7}{16}$  in.

If anyone is fortunate enough to possess an expanding reamer with a range about  $27/64$  in. to  $29/64$  in., drill the bores out to the full  $\frac{7}{16}$  in. dia. and put the reamer through by hand *afterwards*; the reamer should be set to remove about 0.003 in. I employed this method myself, and the result was quite satisfactory.

There is another method of holding the block for drilling the bores. On the ML7 lathe it will be found that the block can be clamped (by each cylinder flange in turn) under the tool-holder, the other end being swung round and bedded against the nearest T-slot in the cross slide.

The cylinder has to be packed up to bring it to lathe centre height and must be adjusted most carefully to ensure that all the faces are square. If this is not done there will be plenty of trouble later on when the covers are fitted!

The next operation is to drill and tap the exhaust pipe. This can be done by holding the block in the 4-jaw again and drilling and tapping from the tailstock in the usual manner.

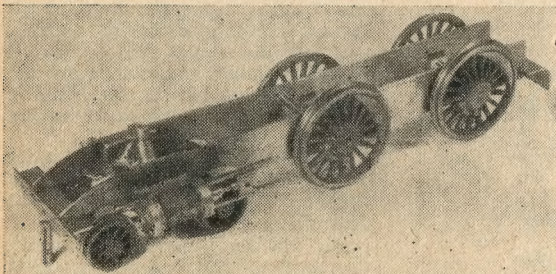


*The cylinder block held in the 4-jaw for facing the ends*

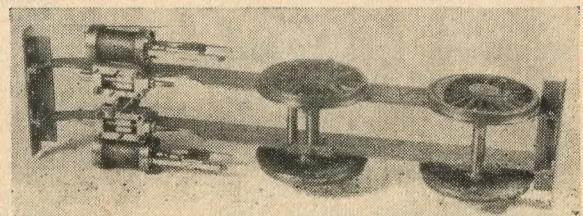
Use  $5/32$  in. drill and tap  $\frac{3}{16}$  in.  $\times$  40 T. Be careful not to go down too far with your drill or you will break into the live-steam passageway—which can now be drilled and tapped  $\frac{1}{4}$  in.  $\times$  40 T right through.

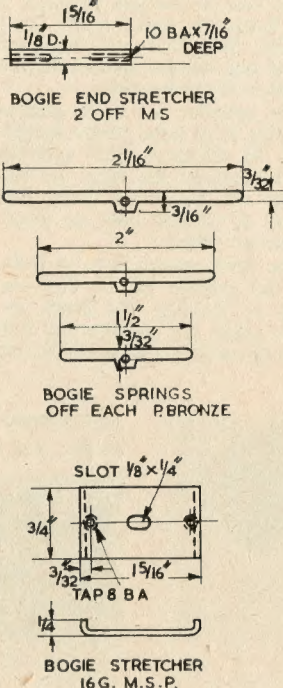
The bolting flanges look a bit tricky to machine; unfortunately they are not easy to file as the cylinder flanges get in one's way.

But again milling machine owners are in clover! Simply put two side and face cutters on your arbor, any diameter between  $1\frac{1}{2}$  in. and 3 in. and thickness around  $\frac{1}{8}$  in. to  $\frac{1}{4}$  in.,



*Left: Chassis, with the cylinders and slide bars fitted  
Below: The underside of the chassis*





If you are fortunate enough to have a graduated hand wheel on your leadscrew (as on Super 7 lathes, etc.) use this for gauging the depth of the ports, but *don't hurry*! It doesn't take much to break a  $\frac{1}{16}$  in. dia. cutter.

## 4-4-0 TENDER ENGINE . . .

continued

The steam and exhaust passages are next drilled, the block being set up on the drilling machine table at the required angle, and the drill "sighted" so that it will come through at the correct point. It will be found easier to file a small flat at each cylinder end to take a centre pop, following up with the drill in the usual manner.

Before attempting to drill the exhaust passage, centre pop the port deeply *slightly nearer the centre of the block than the exact centre of the port*. This is because the drill tends to "lean over" towards the outer edge of the port, due to the angle the drill makes with the port face—and there is always the danger of the side of the drill catching the edge of the port.

### SLIDE VALVES

I made my slide valves from hard brass bar  $\frac{3}{16}$  in. square, and the whole of the machining was done by a slot drill and an end mill, held in the 3-jaw. The best way is to bolt a small machine vice to your vertical slide, with the jaws horizontal, and clamp the bar in this. Mill out the recess first, using the  $\frac{1}{16}$  in. dia. slot-drill again, checking the vertical-slide dial and cross-slide dial to ensure correct dimensions; the ends can then be machined with an end mill about  $\frac{1}{4}$  in. dia. by setting the bar to overhang the machine vice at one end.

The slot across the top of the valves could be cut with a slitting saw, although the  $\frac{1}{16}$  in. slot drill could be used again. But in this case remove some of the metal first with a hacksaw.

### STEAM CHESTS

The steam chests can be milled, machined in the 4-jaw or even filed. The bosses can be turned at the same setting, though it is important to get the casting running quite true in the chuck.

After drilling the gland boss, run the drill right through and make a small centre pop on the far side of the steam chest, remove the steam chest from the chuck and check the position of this centre. If it should be out, it can easily be corrected by means of a centre punch. Drill this second hole undersize to start with, and check once again before opening out to final size ( $\frac{3}{8}$  in.).

The gland boss can then be opened

out to  $\frac{7}{32}$  in. dia. and tapped  $\frac{1}{4}$  in.  $\times$  40 t or 32 t.

The valve rods are made from  $\frac{1}{8}$  in. rustless steel, the flats to fit the slot in the valve being hand filed, and the rear end threaded 5 BA—or, better still,  $\frac{1}{8}$  in.  $\times$  60 t. A very small flat should be filed on the front end of the valve rods (the part which works in the front bar of the steam chest) in order to prevent any possibility of water being trapped at the end of the hole.

### CYLINDER COVERS

The cylinder covers are chucked in the 3-jaw and the inside face machined to a close fit in the bores. In the case of the rear covers these should be centred and drilled ( $\frac{1}{8}$  in.) at the same setting. To machine the other side, the covers should be held in a split ring in the chuck; the gland boss can then be opened out and tapped  $\frac{1}{4}$  in.  $\times$  40 t or 32 t. A pilot tap with  $\frac{1}{8}$  in. dia. pilot is very useful here, to ensure truth.

The fixing holes may be set out on one cover and this used as a jig for drilling the cylinder block. Use a No 50 drill, tap the holes in the cylinder 8 BA, then open out the cover holes with a No 43 drill. Eight BA hexagon-head screws,  $\frac{3}{16}$  in. long, are used, four being required for each cover.

The 8 BA tapped holes for the slide bars are spaced  $\frac{19}{32}$  in. apart, and as it is very important to get these at exactly the same distance from the piston centre line, it is worth temporarily plugging the hole in the gland boss to take the divider point (the plug, of course, having a fine centre put in with the lathe). Alternatively, a little drilling jig could be made up, with a  $\frac{1}{8}$  in. dia. pin to register in the piston rod hole. This would then be swung round to drill each hole in turn.

### PISTONS

A short length of  $\frac{1}{2}$  in. dia. drawn phosphor-bronze bar is used for the pistons. Rough turn the pistons to slightly over  $\frac{7}{16}$  in. dia., centre and drill through with a No 40 drill, then chuck separately, open out with No 31 drill for half the length of the piston and tap the remainder 5 BA. The piston rods, of  $\frac{1}{8}$  in. dia. rustless steel, can then be screwed tightly in by holding them in the tailstock chuck and pulling the lathe belt by hand.

If you have one, a collet is ideal for the final finishing of the pistons. Alternatively, make up a split bush held in the 3-jaw. Personally, I don't usually bother about either, and use the 3-jaw direct but with the jaws packed out with a strip of brown paper, using a dial gauge direct on the

piston rod to ensure true running. The packing groove can be turned with a small parting tool.

### SLIDE BARS

The slide bars are filed down from  $\frac{1}{4}$  in. square bright mild steel or silver steel as preferred; the ends are threaded 8 BA, the 4-jaw chuck being used to hold them for turning and threading the ends.

### CROSSHEADS

Bright mild steel  $\frac{9}{16}$  in.  $\times$   $\frac{1}{4}$  in. section is required for the crossheads, so mill or saw and file up enough for the two crossheads from the nearest section available (probably  $\frac{3}{4}$  in.  $\times$   $\frac{1}{4}$  in.).

Chuck the bar in the 4-jaw and set to run true, then turn the boss but do not drill it for piston rod at this stage. Incidentally, a small boring tool may be found useful for "cutting-in" between the boss and the body of the crosshead, the boring tool being set straight in the tool-holder instead of the usual crosswise position used for boring. Then reverse the bar and turn the other end as before.

The next operation is to mill the grooves for the slide bars. If a regular milling machine is not available, this can be done in the lathe very easily by clamping the bar in a machine vice bolted to the vertical slide and traversing across a  $\frac{1}{4}$  in. end mill or slot drill held in the collet or 3-jaw. By engaging the lead-screw and turning same by handwheel, the exact depth of cut can be regulated. The crossheads can then be drilled and opened out for the little-end with a pin drill.

To drill the crosshead boss, put the crosshead between the slide bars (with the rear cover removed from cylinder), run it hard up against the gland and clamp it there; a  $\frac{1}{8}$  in. drill can now be run through from the back and a countersink made on the boss. Remove, drill No 31 and ream out with a  $\frac{1}{8}$  in. reamer until the piston rod is a nice push fit in the boss. Make a small countersink in the outside of the boss ready for drilling.

The crosshead pins are straight-forward, being turned from  $\frac{1}{4}$  in. dia. silver steel. Use 7 BA nuts on the outside faces to lock them in position.

### Amendments to drawings

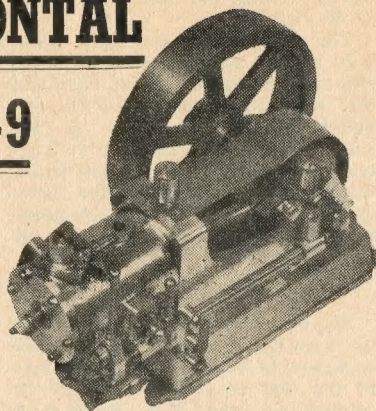
Cylinder covers: pitch of 8 BA tapped holes should be shown as  $\frac{19}{32}$  in. apart. Steam chest and cover: holes shown No 44, should be No 43. Bogie springs: quantity each should read "2 off"; material should read "P. Bronze 0.016 in." Bogie stretcher: slot should be  $\frac{1}{8}$  in.  $\times$   $\frac{3}{8}$  in.

● To be continued

# A 60 c.c. HORIZONTAL GAS ENGINE—9

This week EDGAR  
T. WESTBURY deals  
with the governor  
control mechanism

Continued from 24 October 1957, pages 568 to 570



THE fact that the basic design for this engine does not include any provision for automatic speed control, or "governing," as it is termed, has led some of my readers to remind me that a stationary engine of any kind cannot be considered complete without it.

This, in a general way, is quite true, because if an engine is left to its own devices, without the constant supervision of a driver, the speed is bound to change with any variation of load, and in the case of load being entirely taken off, such as by shedding or breaking a driving belt, it may race away at a dangerous speed. Apart from the consequences to the engine itself, damage to life or property

may be the result, and as a matter of fact some nasty accidents of this nature have occurred, even with small, low powered machinery.

Strangely enough, however, scarcely any mention was made of governing by the many readers who gave suggestions, and even otherwise complete specifications, for the type of engine they would like to see described. It is presumed, therefore, that they would run an engine of this size either under hand control, or direct-couple it to a machine which would run under constant load, such as a charging generator.

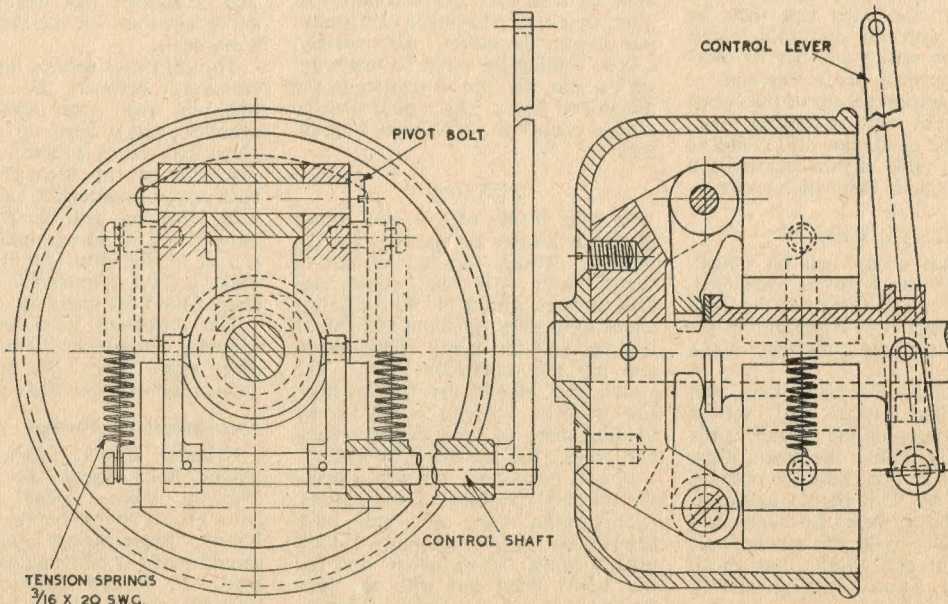
While this has been considered satisfactory in many small stationary engines which have been designed and built in the past, I have considered it desirable to provide for the fitting

of a governor, as an extra accessory, but without the necessity for any alteration to the basic design.

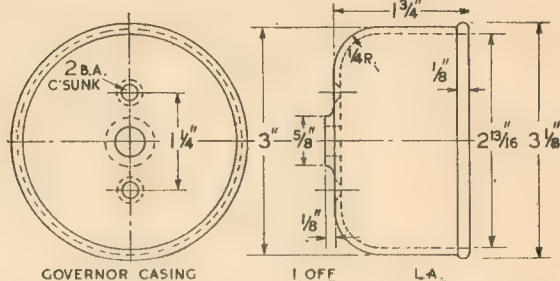
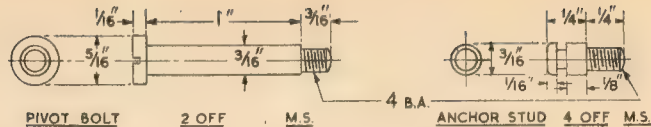
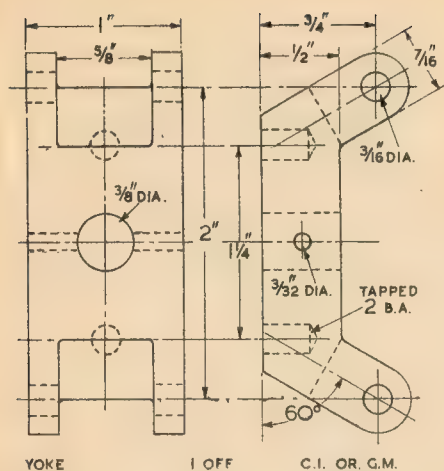
There are several methods of obtaining automatic speed control, all of which have been employed with some practical success. In engines coupled to electrical generators, solenoid governors have been employed; the pressure of the forced lubrication system, or water circulation, the depression in the induction system, and even, in air cooled engines using a ducted fan, the air pressure created thereby—all these have been utilised to keep speed constant within more or less narrow limits.

The old inertia governor—known variously as the pendulum, vibrating, or pecker type—with its "hit-or-miss" action, is now quite defunct, and few, I think, have ever mourned its passing. Its only merit was simplicity, and its worst defect was the irritating and unpredictable "syncopated rhythm" in the beat of the engine which it produced. But "hit-or-miss" governing has been applied also in connection with centrifugal governors; a particularly brutal example was that used on some American horizontal engines, where the governor, if speed rose above the set limit, intercepted a catch on the exhaust valve push rod to hold the valve open and thus prevent the normal power cycle from taking place until the speed was reduced.

A very simple and effective—though inherently wasteful—application of the centrifugal principle is its use to



GENERAL ARRANGEMENT OF GOVERNOR



operate a cut-out or earthing switch in the ignition system, but apart from the uneconomical pumping of mixture to waste, this is liable to result in silencer explosions—usually noisy but harmless, though not always, as I have reason to know !

### Quantity governing

Most modern centrifugal governors on i.c. engines work on the quantitative control system, which sounds highly technical, but means simply that they control the *quantity* of mixture which is allowed to enter the engine, in the same way as the accelerator or throttle control of a car, being quite distinct from older methods which controlled the *quality* (mixture strength) of the charge, or cut it off altogether if speed became excessive.

The mechanical part of the governor itself is a direct adaptation of the original governor applied to early steam engines by James Watt, and it can be driven in any convenient way, by direct attachment to a main or subsidiary rotating shaft, by gearing, belt or friction drive. It may be mentioned that the latter "non-positive" methods have never been trusted by i.c. engine designers, owing to the disastrous effects likely to be caused by governor failure.

The "power" of a governor is defined as the amount of force which it can apply to the operation of the control gear, and it depends upon the mass and velocity of the rotating weights. Thus it is generally desirable to run the governor as fast as possible; some horizontal engines have had the mechanism incorporated in the fly-wheel (a typical example in a model is the adaptation of the ME Road Roller engine as built by Mr R. L. A. Bell, of Yeovil) or geared up from the camshaft, usually on a vertical shaft.

It might be thought, therefore, that in designing the governor to be mounted on an extension of the camshaft, which runs at half engine speed, I have handicapped its performance; but in fact, this is not so, because this is a favourable position for efficient operation of controls, and it also allows the fitting of a very robust and adequate size of governor without making it abnormally out of proportion to the rest of the engine. To build a really effective and reliable governor in exact scale proportion would be difficult, whatever type of drive or working position is adopted.

### CONSTRUCTION

As will be seen from the general arrangement drawing, the main working parts of the governor are enclosed in a bell-shaped housing, and comprise a yoke which carries two pivoted flyweights, having inwardly-extended bell cranks with fingers which bear against the thrust flange of a control sleeve. A grooved collar on the remote end of the latter operates a forked lever, the movement of which is communicated to the carburettor throttle.

The tension springs attached to the flyweights normally tend to pull them towards each other, so that they rest with the "horns" in contact, but when rotated at appropriate speed, the centrifugal force pulling the weights outwards overcomes the tension of the springs, and the fingers move the control sleeve to the right, displacing the forked lever, the movement of which is multiplied by the increased length of the control lever. Thus a very small movement of the weights will result in a substantial movement of the controls.

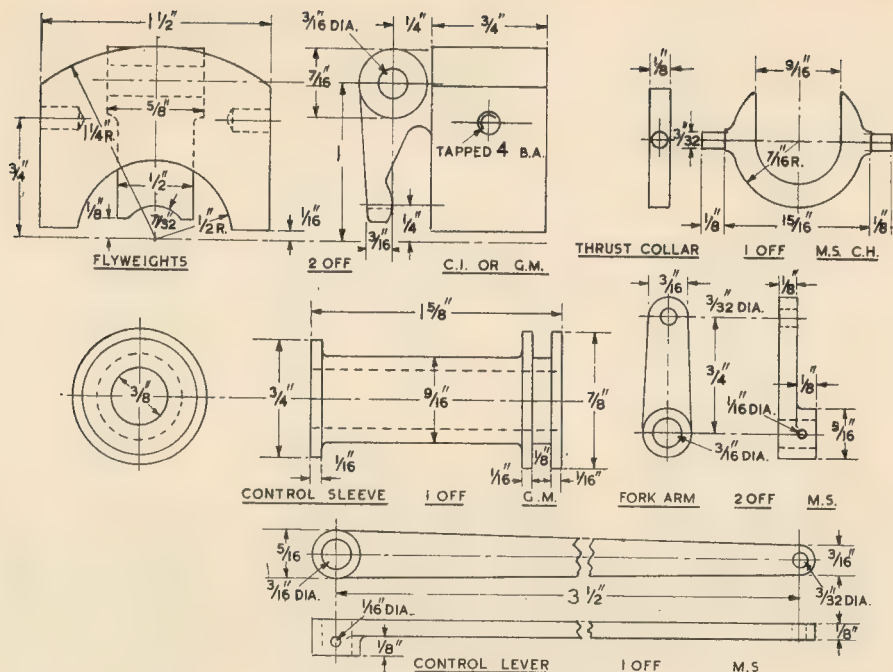
It would be possible to adjust the strength of the tension springs so that they exactly balance the centrifugal

force of the weights at the speed at which the engine is desired to run, but usually they are somewhat on the weak side, and an extra spring is applied to the control lever. This enables any backlash in the control system to be taken up, and adjustment of tension to be made, while running, if necessary; furthermore, it allows of fitting an "overriding control" so that the engine can be slowed down independent of the governor action.

Most of the components could be made fairly easily from the solid, though castings would simplify the work entailed, and also economise in material. The yoke, for instance, could be cut from a square bar 1 in.  $\times$  1 in.  $\times$  2 1/2 in. long, and though cast iron or gunmetal is specified, mild steel or duralumin would serve equally well. In any case, it should be chucked truly for drilling and reaming the central hole, which should be a snug fit on the shaft; the rear face should also be machined, and it is possible to machine away a good deal of the unwanted material on both front and rear while set up in the lathe and located from the bore.

It will help in the setting out and machining of the pivot holes if the sides are true, and parallel to the bore axis. These holes must be drilled and reamed square with the bore, and at equal radius from the centre. The gaps between the lugs may be cut out by milling, or by drilling, sawing and filing; their inner faces may be trued, to fit the knee of the flyweight with no perceptible end play.

Readers who are skilled in forming sheet metal may prefer to use this technique for producing the housing, rather than using a casting or machining from solid. It could be spun over a wood or metal former, from copper, soft brass, or aluminium, and need not be thicker than 18 gauge, as



the open edge could be stiffened by beading.

If, however, it is machined from solid, or otherwise, there will be a tendency for the thin section to "sing" or chatter; the remedy, when turning the inside, is to clamp a ring over the outside; even a few turns of insulating tape wound round it may suffice. For external machining, a wooden plug in the inside will be equally effective. It is, of course, essential that the housing should run truly when fitted.

In the absence of a casting, the two flyweights can be machined, and in fact almost completely formed, in one piece, then finally separated by sawing through the middle. Note that the weights of various metals are widely different, and thus light alloy should not be used; brass or gunmetal has the highest specific gravity of normally available metals, and is, therefore, best for this purpose. The external diameter of the pair is 2 1/2 in., and overall length 1 1/4 in., one end is bored 1 in. dia., and the other 7/8 in. dia., while the centre portion can be chambered out if a suitable internal tool is available.

Next the sides may be machined away parallel and symmetrically to a width of 1 1/2 in., preferably by mounting the work on an angle plate; the rear portion, for a length of 1/2 in., is further reduced in width as shown, by milling or any other available means.

After marking out the positions of

the pivot holes, which again must be quite symmetrical to keep the system in balance, the job may again be set up on the angle plate for accurate drilling and reaming. It is desirable to shape the fingers before separating the two weights, as this enables them to be readily compared, to ensure symmetry. The sides of the weights are finally drilled and tapped to take the spring anchor studs.

The control sleeve may be turned entirely from the solid at one operation, or if no chucking piece is allowed, it can be drilled and reamed, then mounted on a mandrel for turning the outside. It should slide quite easily and freely on the camshaft, and the groove of the collar should be smooth and accurate. A hardened steel washer is interposed between the flange of the sleeve and the fingers of the weights, and this may with advantage be sweated to the flange to avoid risk of cutting into the shaft, but it must be centrally located, which may be ensured by fitting an

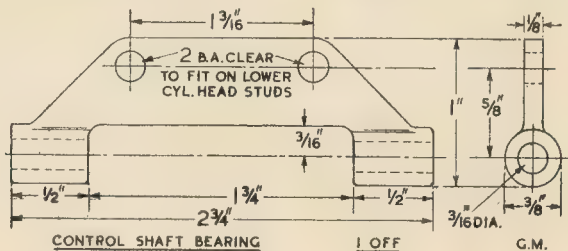
aluminium plug in the hole during the sweating operation.

Care should be taken in machining the pivot bolts, to ensure that they are accurate and fit the holes in the weights neatly but freely. As an alternative to turned bolts, pieces of silver steel rod screwed at each end may be used, but the nuts should not screw up hard enough to pinch the lugs and thus bind the weights. The use of split pins or circlips as a means of retaining the pivots may be preferred, and will be quite suitable so long as they give proper security.

It should always be remembered that the fatal enemy of governor mechanism is friction; the action of the working parts should be as smooth as silk when assembled, but if the fit of the parts is sloppy, they will rattle undesirably when the engine is working.

To make the horseshoe thrust collar which fits in the groove of the control sleeve, a piece of 1/8 in. mild-

● *Continued on page 655*



**W**HATEVER its size, there are certain features of the simple two-stroke engine that are virtually automatically established from the functional principles—and while it is possible to vary the proportions reasonably, to do so substantially is to risk loss of performance.

Knowing what are reasonably good proportions, the dimensions of main components, height of ports, etc., can be obtained without difficulty for any size of engine, and to these can be added the detail design necessary to complete the engine.

In model sizes many engines have been started almost casually on the idea that a particular piece of material seemed suitable for some component—for example, a block of aluminium or duralumin for making a crankcase, or a design may have been evolved deliberately to utilise stock material. In such circumstances the constructor has often had to adapt dimensions to suit material and evolve an engine of appropriate capacity—which, as in orthodox free design, has required a preliminary layout on paper.

For a simple two-stroke engine there is a good deal to be said for a "square" design, with bore equal to stroke, though reasonable variations

## TWO-STROKE ENGINE PROPORTIONS

can be made either way. A long stroke, however, may add to crankcase capacity, so influencing pumping efficiency—and a short-stroke "over square" engine requires shallow ports.

With bore equal to stroke, the basic layout can be as at *A*. At the intersection of vertical and horizontal centre lines is the centre of the circle described by the crankpin—with t.d.c. at *L* and b.d.c. at *M*. A suitable

### By Geometer

centre distance for the connecting rod is twice the stroke, where again reasonable variations are possible, not overlooking that the longer the rod, the greater the crankcase volume, while the shorter the rod, the greater its angularity at mid-stroke, with the chance of its touching the cylinder. Centre length chosen, gudgeon pin centres are marked at *N* and *O*.

The length of the piston for a simple two-stroke engine must always be greater than the stroke to provide overlap on the ports, so that the exhaust port, for instance, is not opened to the crankcase at t.d.c. Any overlap dimension can be chosen, depending on the layout of the ports and the fitting of the ring—or rings—in the piston.

On occasion, the overlap may have to be considerable; otherwise, it should be some small round dimension like  $\frac{1}{16}$  in. or  $\frac{1}{8}$  in.

In positioning the gudgeon pin the overlap should be brought down the skirt as far as possible, thus reducing crankcase volume. Then the height above the gudgeon pin added at *N*, and the depth below subtracted at *O*, give the cylinder length *P* and *Q*. Similarly, the height above the gudgeon pin at b.d.c. gives the bottom of the exhaust and transfer ports *R*, and the depth below the gudgeon pin at t.d.c. gives the top of the inlet port *S*.

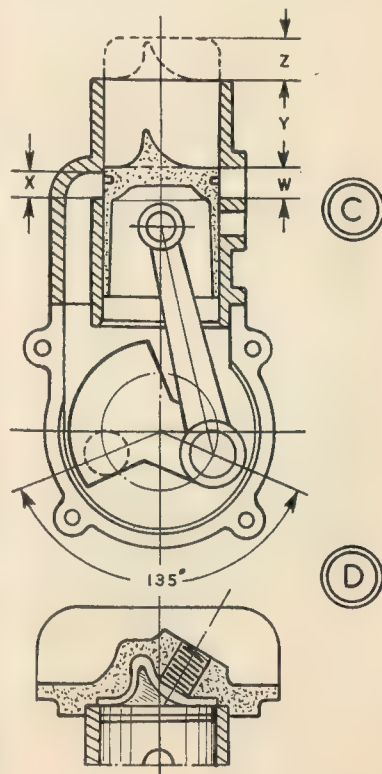
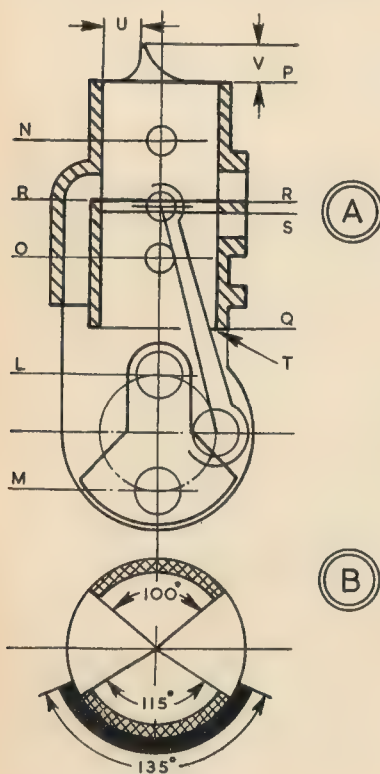
Placing the connecting-rod centres on vertical and horizontal centre lines gives the possible width of the rod and

the clearance at *T*. Should width or clearance be too small, the gudgeon pin may be re-positioned lower down the skirt, and the whole cylinder thereby raised.

For the deflector on the piston crown, the dimension *U* can be a quarter to a third of the piston diameter, while depth *V* can be approximately equal to the height of the exhaust ports, which is governed by the timing and length of stroke.

Using "standard" timing as at *B*, it is transferred as at *C*. On the crankpin circle, the angular opening is 135 deg. With a big-end thus located, the gudgeon pin is positioned on the vertical centre line, and the height above it gives the exhaust port height *W*. With the smaller angle of 115 deg., the height of the transfer port can be obtained *X*, and in similar fashion the inlet port depth from the angle of 100 deg.

Owing to piston deflector height movement through distance *Y* would result in low compression in a plain space depth *Z*, so the cylinder head must conform in part to the piston, as at *D*. ■





*The builder applying a final touch*

## The Sixth Rate is bound for the US

**T**HE model—but not the builder—is going to the USA to be housed in a private collection.

It is the Sixth Rate described in *Ships and Ship Models* last year and seen by many visitors to the 1956 Model Engineer Exhibition, where

felt about selling a model which represents untold hours of devoted work. "By this stage," he told me, "you'd be damn glad to see the back of it—and you can quote me!"

Perhaps this helps to explain why Reg Collins is prepared to part with

*Yes, that is the news. But before his model departed from these shores R. J. COLLINS thought it would be an idea to visit our offices to have it photographed. He did so, and Eric Winter took the opportunity of asking him one or two questions*

R. J. Collins worked on its construction, demonstrating his methods of work to a spellbound public.

So when Mr Collins recently brought along his 12 in. model for photographing, I asked him how he

a model at what he considers a giveaway price. By the time you add the cost of transit and US purchase tax it is already a tidy sum for the collector, and Mr Collins' share is itself subject to income tax on this side!



*A general view of the Sixth Rate*

MODEL ENGINEER

Does he have a soft spot for any model he has built? Mr Collins thought for a moment, and said: "Well, there is one to which I'm very attached. It is a 14-gun Dutchman of 1665, built during the war, mainly in a Civil Defence depot; it was my very first model. Actually it would make a good photograph and I could point to the errors in construction."

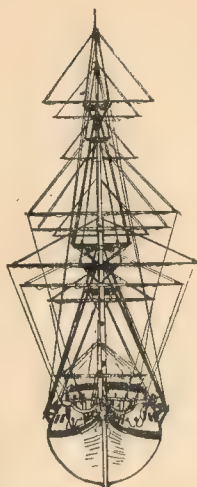
"I'll bring it up sometime." ■



*Stern view of the model*

Drawings for the Sixth Rate (SY 24) are now available from the Percival Marshall plans service. They comprise three sheets—No 1 Running Rigging, price 3s. 6d., No 2 Standing Rigging, 3s. 6d., and No 3 Hull Lines and Details, 5s. 6d. Cost of these plans includes packing and postage.

# MYRMIDON



## A SHIP-RIGGED SLOOP OF 22 GUNS

Part 11—With the remainder of the rigging proper and the details for the yard tackles, cables and anchors, R. J. COLLINS ends his series

*Concluded from 3 October 1957, pages 491 to 493*

**T**HE fore bowlines (Fig. 155), both legs and bowlines, are 3 in., with a 12 in. single block stropped to the forestay collar either side of the bowsprit. Legs, four fathoms, that is 24 ft, run freely through a thimble at the end of the bowline. The main line goes forward to the block at the bowsprit and then straight aft to belay to the arm of the fore bitts. If there were three sheave in the bitts it would pass through the outer one.

The main bowline (Fig. 156), also of 3 in. rope, has legs of 4½ fathoms. The line goes forward to a 12 in. double block stropped to the after side of the foremast about 6 ft from the deck and then runs forward to belay at the rail. It will be noted that the starboard bowline belays at the port side of the rail and the port bowline to the starboard side.

Fore top bowlines (Fig. 157) and legs 2½ in. with the legs five fathoms. From here the line goes forward to a 9 in. block at the side of the bowsprit cap. Using a slightly longer strop it could be fastened to the same eye bolt as the sprit yard lift. It then goes aft to the outer pins on the fore sheet bitts.

Next the main top bowline (Fig. 158) of 3 in. with legs 5½ fathoms. The lines go forward to a pair of 11 in. blocks stropped to the fore mast head just below the cap and then run straight down to the inner sheave of the fore jeer bitts. The mizen top bowline (Fig. 159) of 1½ in., with legs of 2½ fathoms, cross over to a 6 in.

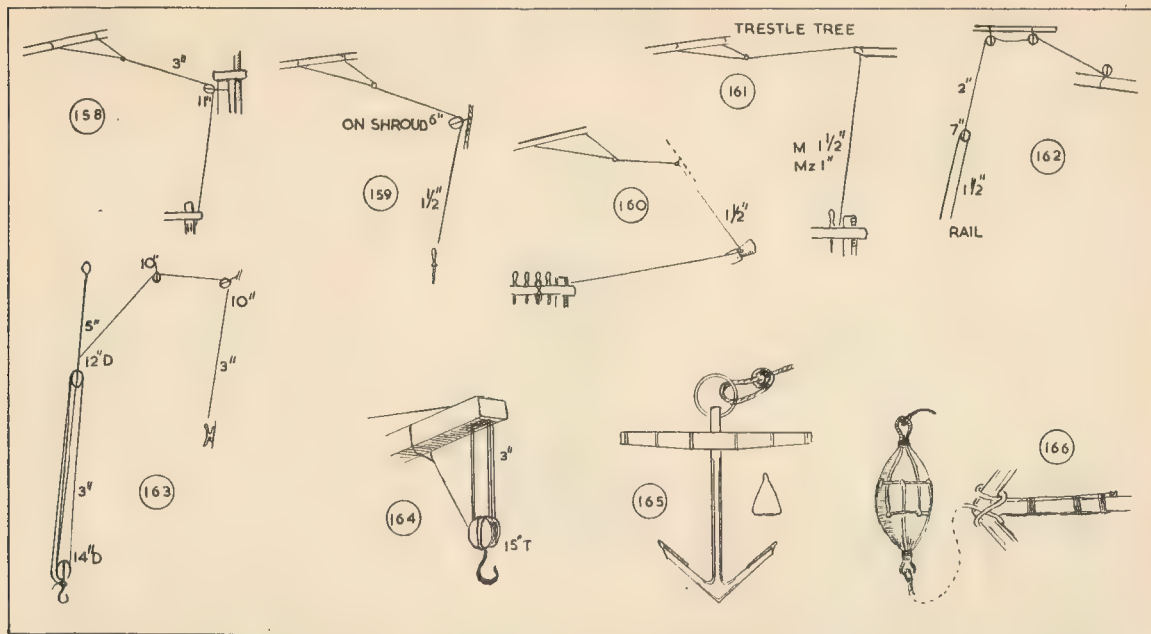
block on the main shrouds just above the crojack brace block and then down to the third pin in the second pin rack.

Fore top gallant bowlines (Fig. 160) of 1½ in. with legs of 6½ fathoms. These run forward to a thimble on the fore top gallant stay, down to another thimble at the peak of the jib and then aft to the middle pins of the fore sheet bitts.

The main top gallant bowlines (Fig. 161) of 1½ in., with legs of 7 fathoms, go forward to the sheave holes in the after arms of the fore topmast trestle trees and then down to the middle pins of the fore jeer bitts. The mizen top gallant bowlines are of 1 in. with legs of 3 fathoms. The line runs forward to the sheave hole in the main top trestle trees and then down to belay at the second and fourth pins on the bitts abaft the main mast.

The fore leech line (Fig. 162) in a real ship would be connected to the leech or side of the sail, but in this model it starts—made off to itself—around the outermost of the three blocks of the yard. From there it goes through the outer sheave of the outside pair of blocks slung under the fore top and then about halfway down to the rail it ends in a 7 in. single block. The falls of 1½ in. lead down to the rail. The main is similar and this, too, leads down to the rail—the rail of the quarter deck.

The tackles (Fig. 163) are formed by a pendant eye-spliced to the yard arm ending in a double block and fall with another double block which carries a hook. The pendant is controlled by a lighter line called a



"tricing line" running through smaller blocks, i.e. tricing blocks.

One of these is on the yard just outside the inner boom iron and the other on the first shroud just below the futtock stave. The 5 in. pendants are approximately one tenth the length of the yard—the pendant blocks 12 in. doubles, falls and tricing line 3 in., fall blocks 14 in. doubles, tricing blocks 10 in. I can find no definite belaying point but one could be made fast to a cleat on the first shroud though, again, I have not placed one there on the rigging plan. The hook of the tackle should be engaged beneath the first lower dead eye and the running end either brought inboard to some convenient point or belayed beneath the lower block.

Cat tackles (Fig. 164). Falls of 3 in. with a 15 in. treble block, iron stropped, with a large hook at least as large as the block. The cat head should have three sheaves, but if you have only put two make the block a double. Splice a loop in the end of the fall and slip it over the cat head, then from there reeve through the block and sheaves and back through the snatch block on the rail and belay to the fifth timber head.

Anchors (Fig. 165). There would be several anchors of various sizes, but I have contented myself with just a pair of the largest. All the sizes are on the drawing and what you make it from is a matter of choice.

Metal is undoubtedly the best, though I have made very good ones from black plastic, cutting the shank

and arms from one piece and gluing on the flukes. If you use plastic bear in mind that it is rather brittle.

The cable, which is 13 in., should be wormed with its end parcelled or capped. In making the actual cable the end few fathoms were spun up a little looser to enable it to be bent, and a special knot was used to secure it to the anchor ring. The cable is brought inboard through the hawse-hole, hitched over the riding bits and then passed below through the forward hatch.

Anchor buoys can be made and hung in the lower fore shrouds. These were casks, but for the model they can be turned up. The buoy rope can either be coiled and hung beside the buoy or a part of it secured to the anchor. I suggest one anchor be lashed to the chains and the other one slung from the cat. The latter will have the buoy rope. (I have shown how it is fixed.)

It is perhaps rather late in the day to mention the stand. I have not given any details because it is so much a matter of individual choice. Personally, I prefer the plainest of black stands so as not to detract from the model. But, I repeat, this is a purely personal choice.

So once more I come to the end of a series. Again I say should you meet any difficulties don't hesitate to write to me care of the Editor. The pen friends I have made, from as far apart as Canada and Tasmania, are not the least of my rewards.

Good modelling—and good luck. ■

## The Sentinel AGRICULTURAL TRACTOR

By Kyrle W. Willans

**F**EW persons other than the president of the British Agricultural Engineers, his brother, L. R. Bomford, and myself remember the attempts made to produce a steam tractor which would be to the agricultural industry what the Sentinel steam wagon was to road haulage.

Early in 1923 I came into contact with Mr Stephen Alley, chairman and managing director of the Sentinel Company, and, as a steam tractor was being produced at Shrewsbury to compete with the conventional 5-ton tractor, I made the suggestion that an agricultural version had possibilities.

The Sentinel tractor at that time followed the company's standard wagon practice with a dead back axle, the differential incorporated in the crankshaft, no free engine and no change of gears. At first sight it was obvious that the reduction between

crankshaft and back axle was nowhere near low enough for ploughing, and a dead countershaft was fitted, carrying at either end a double chain wheel.

The drive from either end of the shaft passed to the larger of the double chain wheels and thence by the smaller one to the largest possible chain wheel mounted on new road wheels of steel construction. These road wheels, which replaced the rubber tyred wheels, had traction engine type strakes arranged for fitting with cleats should occasion require it.

During the years 1924-6 there was a great demand in Kenya for powerful trackless tractors. This was encouraged by the importation of numbers of war-time Holt Caterpillar half-track machines which combined pulling power with fantastic petrol consumption. As a result development of a wheeled tractor was laid aside and production was concentrated on a half-track tractor which, however, was soon to be classed as a monumental failure.

This could only be blamed on the tracks, for the tractor incorporated a big enough reduction between engine and track to enable the power unit to give its best. In test near Shrewsbury two four-furrow ploughs were hauled with ease.

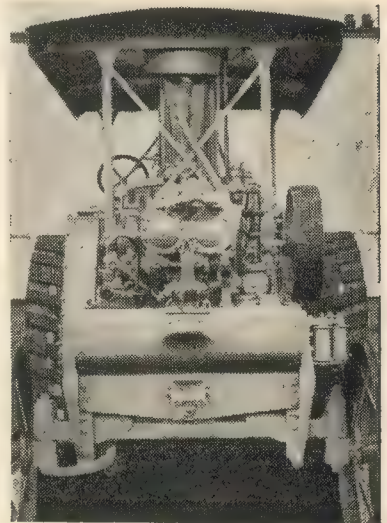
One memory of this tractor lingers. The cross member, by which the engine frame and track assemblies were connected, consisted of an H-section joist with no stiffening whatever. The tractor was connected to a fully-loaded Sentinel wagon, with the brakes on, and then moved off. The result was that the engine and frame seemed to settle down on the tracks as well it might. All that happened was that the web of the joist, being unstiffened, just bent over.

I think that the best tribute to the tractor occurred in the presidential address of the president of the Institution of British Agricultural Engineers in 1955. Opposing the general belief that the steam engine had carried mechanisation as far as steam could



and that further development had to await the internal combustion engine, the president remarked that the modern tractor picked up, carried, hoisted, stacked and shovelled by means of complicated hydraulic mechanisms whereas the steam tractor could do all these jobs simply by using steam.

He continued: "In the 1920s the Sentinel Wagon Works produced a prototype direct-traction steam tractor which astonished steam cable-ploughing enthusiasts by hauling eight 14 in. wide furrows in heavy West Midland clay. There was no evidence of excessive soil-packing by the wheels and it compared favourably in fuel and water consumption with compound steam cable-ploughing engines. It was operated by one man and there was no material in it that would have prevented its being made in 1890 except the roller chains." ■



*The Sentinel agricultural tractor and (below) a half-track Sentinel roadless tractor near Shrewsbury, 1925*



When space on the bench and in the workshop is very limited why not use

## a pedestal type **TOOL GRINDER**

By C. Maude

**H**AVING lost my 6 in. bench grinder in an unfortunate workshop fire some time ago I decided to make a pedestal type myself. The reason for this was that I could not use any bench room, or fix shafting or motors to the walls.

Having a  $\frac{1}{2}$  h.p. motor by me, bought from one of the regular ME advertisers for £3, I set to work to rig up a useful machine as cheaply as possible. Most of the parts came from the scrap yards; the ball races,  $\frac{1}{2}$  in. internal bore, I got from an ex-government surplus store for 1s. each, but they can be obtained cheaply from a car wrecker.

The only new parts were one piece of  $\frac{3}{4}$  in. dia. mild steel (free cutting variety), the headstock casting, the V-belt (a  $\frac{1}{2}$  in. size A-section) and the two V-pulleys,  $3\frac{1}{2}$  in. pitch circle dia. and  $1\frac{1}{2}$  in. p.c.d.

The base is a piece of m.s. 18 in.  $\times$  14 in.  $\times$   $\frac{1}{4}$  in. with a piece of heavy bar  $1\frac{1}{2}$  in.  $\times$   $1\frac{1}{2}$  in. screwed on the underside around the edges to add weight. An alternative method would be to use a shallow wooden box filled with concrete, after first placing the steel pedestal tube and the motor holding-down bolts in position.

The pedestal has two slot holes, one front and one rear where the motor pulley comes, to allow a little clearance for the belt. This position is determined by how far the motor shaft is from the floor on base. The large hole to the right of the tube is to allow the motor pulley to be inserted inside and to ease the situation should a new belt be fitted later.

If a steel or iron base is used it could be welded to the tube or fixed by three angle brackets, say of  $1\frac{1}{2}$  in.  $\times$   $\frac{5}{16}$  in. I had mine welded by the local blacksmith, also the headstock mounting platform plate. This latter could also be fixed in position by angle brackets on the inside of the tube. This plate is  $6\frac{1}{2}$  in.  $\times$  5 in.  $\times$   $\frac{1}{4}$  in. or  $\frac{3}{16}$  in.

The motor platform is hinged at the rear and the motor is swung on the belt, thus giving constant tension. The platform is made of m.s. or iron and is  $8\frac{1}{2}$  in.  $\times$   $7\frac{1}{2}$  in.  $\times$   $\frac{1}{4}$  in. or  $\frac{3}{16}$  in. The hinge movement is by lugs on the platform either welded, brazed or screwed on. A shallow U-bracket is fixed on the baseplate, made from  $1\frac{1}{2}$  in.  $\times$   $\frac{1}{4}$  in. m.s., and a long pin or bolt secures the lot.

Tool rests are made of m.s. and are bolted on to each side of the headstock casting. They are slotted to allow for wear and are in two parts. The horizontal one is slotted, to allow for wear, the upright one, made from a section of angle iron or steel 2 in.  $\times$  2 in.  $\times$  1 in., is fixed to the horizontal member by  $\frac{1}{4}$  in. setscrew and wingnut so that various angles can be set.

The spindle (length to suit individual tastes and wheel thicknesses) is first centred in the lathe, turned down to suit the ball races (not less than  $\frac{1}{2}$  in. dia.) at each end. The plain portion in the middle is left to length to suit the distance between the two races.

When assembled in the headstock a little bush is then made and fitted to the spindle at each side. These should be from  $\frac{3}{4}$  in. to 1 in. long and  $\frac{3}{4}$  in. o.d. with hole to suit the particular spindle. These allow the wheel cups and wheel to be tightened up right against the centre unit of the ball races, thus making everything solid.

Wheel cups are made from  $2\frac{1}{2}$  in. o.d. m.s. offcuts, and the threads on the spindle are best cut in the lathe, but it may be possible to use dies if great care is taken to start off truly.

The headstock is cast iron, and made to machine on the trusty ML7, so, therefore, the centre height had to be  $3\frac{1}{2}$  in.

The bottom of the casting is cleaned up a little, then a piece of stiff brown paper is laid on the lathe bed. The headstock casting is placed on it, each end face, being chalked and each in turn is drawn across the tailstock centre point, thus scribing a line. The



*The completed tool grinder mounted on its pedestal*

casting is turned on its side on the lathe bed or marking table and the centre determined by the use of a pair of dividers.

These points are centre popped and drilled through by fitting  $\frac{3}{8}$  in. drill in the lathe chuck, pushing the casting along by tailstock reverse, and repeating other side.

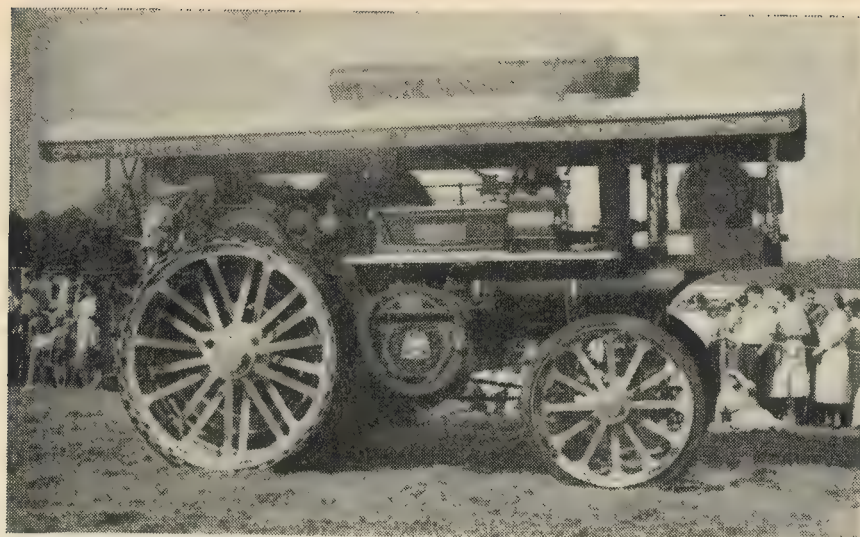
The holes are opened up by using a large drill which should be  $\frac{3}{4}$  in. at each end. Clamp the casting on to the lathe bed, place the boring bar in position and to open up the hole by degrees, gently tapping the fly cutter out until the correct size is reached to receive the ball race.

The face of the casting can be cleaned up to receive the dust covers while in position. After one side is finished turn the casting round and repeat.

The boring bar is held lightly in the lathe chuck and is driven by a  $\frac{1}{2}$  in. steel peg protruding  $\frac{1}{2}$  in. in from one end. This peg goes between any two jaws and the feed is from the tailstock end via the tailstock centre; the amount of movement of the boring



A 1915 4 n.h.p. Fos



Above: KITCHENER—a 1920 7 n.h.p. Fowler showman's engine owned by Mr John Crawley



# AROUND

THE



Left: This 6 n.h.p. Burrell from Braintree, Essex, has been at work for over 50 years

Below: A 191

Below: Awaiting the next event in the paddock is this 1932 8 n.h.p. Burrell



ster showman's tractor



Above: SUFFOLK PUNCH, a 1919 Garrett—believed to be the sole survivor of its class

This week, news from Beds  
and Leicestershire . . .

# ND RALLIES

9 Fowler showman's engine owned by  
Mr T. Sage, of Leicester



## THE WOBURN RALLY

By I. J. Belcher

**T**WENTY-FIVE thousand people, many of whom gained free admission owing to chaotic traffic conditions, attended the 1957 Woburn Park traction engine rally. Opener was the Duke of

Bedford, who rode from Woburn Abbey on Mr John Crawley's ex-showman's Fowler *Kitchener*.

Obeing a pre-arranged signal drivers of the forty-three engines present—a record number—greeted the Duke's arrival at the course by simultaneously sounding their whistles. The engines then featured in a grand parade, following which the afternoon's sport quickly got under way. This included obstacle and steering races, musical chairs and a thrilling tug-o'-war.

Later, during an interlude, Mr Harold Darby gave a recital on his fine organ, this proving a highlight of the whole show.

Below: This 1923 7 n.h.p. Clayton and Shuttleworth was used for threshing up to 1954



## WOBURN RALLY . . .

### From far and wide

Until late the previous Saturday evening four engines were on exhibition. They were Mr Crawley's *Kitchener*, Mr Darby's *Lord of the Isles*, Mr J. Wharton's *King George VI* and Mr P. Barber's *Prince of Wales*. This display created immense interest, spectators travelling long distances to see it.

The rally, which was jointly organised by the National Traction Engine Club and Bedford Steam Engine Preservation Society, was adjudged so successful that it is intended to stage another at Woburn next year. The Duke has already given the "go ahead" for arrangements to begin. ■



*Above: DREADNOUGHT, a Fowler owned by W. Taylor and Sons, won first prize in the showman's class*

## THE KEGWORTH RALLY

Photographed by  
W. J. Hughes



*Above: An interesting loco-boilered steam launch,*

*A handsome and well-finished Super Sentinel and a little Clayton and Shuttleworth portable of 4 n.h.p.*



MODEL ENGINEER



# GROSVENOR

In response to many requests LBSCR relates this week the conception and construction of a famous LBSCR locomotive of days now, alas, long past

IT is a well-known fact that the antics of a little LBSCR engine were mainly responsible for the starting of this series of notes over thirty-three years ago, and how *Ayesha* "astonished the natives" is now ancient history. She is still running, and steams and pulls as well as ever, though she looks as if a course of locomotive beauty treatment wouldn't come amiss!

For many years she remained the sole representative of the railway on which at one time I earned my daily bread, and correspondents often referred to this in their letters, saying that as I was so fond of the Stroudley engines they wondered why I didn't build one to keep the little Atlantic company.

Well, time and again I vowed to myself that I would do the job and, in fact, I began to accumulate the necessary castings and material to build a  $3\frac{1}{2}$  in. gauge *Purley* or *Wigmore* or one of the other D class tanks that had at one time been my daily companions; but always when I contemplated a start something came along and claimed prior attention.

Incidentally, though it doesn't take you long to read these notes it takes

me a long time to get out drawings and supply guaranteed instructions. The fact that I really do guarantee them involves a lot of experimental work, for I would hate to offer just the results of "paper design" and leave the would-be locomotive builder to find out snags and pitfalls. There has been far too much of that in the past—my correspondence has told many a tale of disappointment directly due to it.

During the air raids of the last war I used to spend the time in the shelter trying to solve problems connected with locomotive design and operation. It was there that I ferreted out what I considered to be the faults in the Webb compounds, and I decided to test my conclusions by building one if I came through alive.

By grace of Providence I came through. I built the engine—and found that my diagnosis was correct. My little compound did everything that the big ones didn't, and now, thought I, I really will build the Stroudley engine.

Now one of my peculiarities is that I often act on impulse or instinct. While looking out the castings I needed, from an accumulation of years, I came across a pair of driving-wheel castings with no crank bosses, beautifully clean, and with "square"

balance weights. The sight of these so reminded me of the driving wheels of one of my favourites, 326 *Grosvenor*—how I loved those graceful single wheelers!—that I decided on the spot to build her in  $3\frac{1}{2}$  in. gauge instead of the tank engine.

Another point in favour was that her boiler was almost identical in size with that of the engine *Jeanie Deans* which I had just finished, and I could use the forming plates.

## No drawings required!

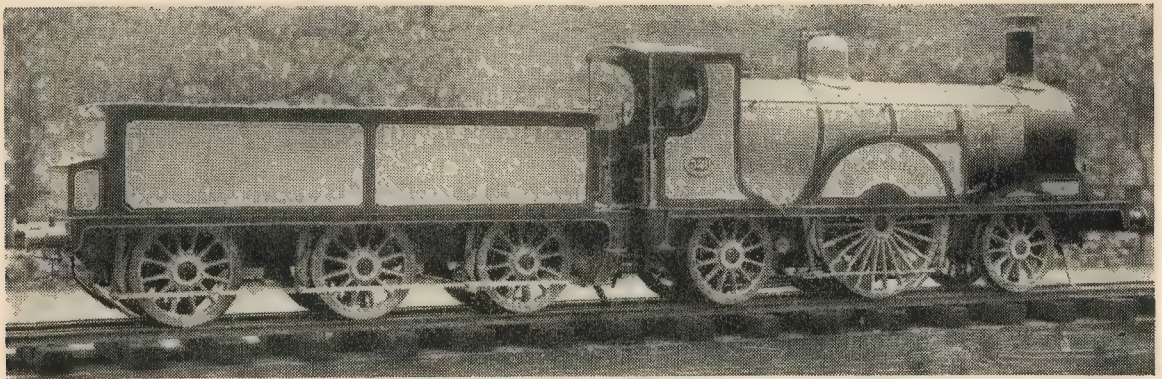
As far as I am personally concerned I see no use in wasting time by drawing out frames and attachments on paper and then doing the job all over again on the metal, so I just got two pieces of  $\frac{1}{2}$  in. steel plate and drew the outline of my frame on one of them straight away.

There was nothing out of the way about this, as I knew every nut and bolt in the big engines, and could visualise the small one. There is a hump in the frames over the driving axleboxes, which are high up on account of the big driving wheels, and this meant cutting away a lot of metal fore and aft, as our nautical friends say.

Now *Curly* is a very lazy person and invariably takes the easiest way when doing a job. Instead of using a hacksaw I put a  $\frac{1}{16}$  in. saw-type milling



The driver's side



*The fireman's side*

cutter on the arbor of my milling machine, gripped the embryo frame plates in the machine vice and let Milly Amp on the floor do all the work. I have a Driver jigsaw, but it jigs far too quickly for cutting steel.

The curves in the frames were formed by running them up to a side-and-face cutter of suitable diameter, and the straight parts were run under a small slabbing cutter. The frames were thus finished without any hand work at all.

The buffer and drag beams were cut and slotted on the miller in the same way, and the frames were then pushed into the slots in the beams, levelled up, and Sifbronzed. A lot of welding is done in full-size locomotive building nowadays, so I was only adapting full-size practice to my small job.

I had a pair of cast hornblocks, which I machined and fitted for the driving axle; but the leading, trailing and tender horns are just the ordinary hot-pressed variety sold for the driving and coupled axles of  $2\frac{1}{2}$  in. gauge engines. They were just the thing for the  $\frac{3}{8}$  in. axles.

All the axleboxes were machined from drawn bronze bar—an easy job for the milling-machine. The wheel-turning was just routine work but as the driving-wheel castings were intended for a 7 ft wheel and those of the big engine were 6 ft 9 in. I had to turn the treads thinner than usual. As it is, the drivers are a shade oversize but it isn't discernible.

The crank axle is made by the press-fit method. I adopted it because the four eccentrics for the Stephenson link motion go between the cranks, and it was the easiest way I could think of. The three sections are reduced in size where they enter the crank webs. The crankpins were pressed into the webs first, then the outer sections with the wheel seats. Next one end of the middle section

was pressed into a web, the four eccentric tumblers mounted on it and, finally, the remaining crank pressed on to it.

I heated the webs before pressing the bits into them. When they cooled the whole lot was as firm as a rock—and still is! The diameter of the axle and crankpins is  $\frac{1}{2}$  in. and the leading, trailing and tender axles are  $\frac{3}{8}$  in.

The big engine had spiral springs to the driving boxes and laminated springs elsewhere, but I fitted the double spiral type to the whole lot as it makes the engine hold the road far better in small size. The British climate plays the dickens with a little railway which obviously can't receive the attention of its full-size relation, and rapidly gets out of alignment both lengthwise and crosswise.

#### Enter the supernatural

I now come to the most curious experience I have ever had during a long lifetime of locomotive-building. Right from early childhood I have had vivid dreams. That isn't at all unusual, I grant you, but the outstanding feature of all mine is that they are all intensely realistic.

The original engine had the steam chest between the cylinders. Now on a  $3\frac{1}{2}$  in. gauge job this means that the steam chest is going to be exceedingly cramped, and it would not accommodate the arrangement of ports and valves that I wanted to fit, beside being awkward for valve-setting. I pondered over this one evening, and looked up a book with details of the Gladstone cylinders and other parts of the Stroudley engines as a memory-refresher. In the book was a fine photographic reproduction of the immortal Billy himself, with a facsimile of his signature.

I was still thinking of these things when I went to bed and then came

the dream. It is over eleven years ago now, and I can't recall the exact words of the conversation, but I'll relate as best I can. In the dream I was in my workshop again, and had the parts of the engine so far made on the bench when who should come in but Billy Stroudley himself! With a cheery greeting he asked how I was getting on with the engine, and when I indicated the parts on the bench he picked up some of them and inspected them, holding them rather close to his eyes as he did so.

He then asked what I was going to do about the cylinders, referred to the small steam chest, and said that a better arrangement would be an advantage. I replied that I thought of using the Gladstone cylinders. He immediately said: "You can't do that because the leading axle will come right in the way of the valve spindles." I smiled and replied: "Well, sir, it's your engine; what would you suggest if you were designing her now, with all the modern improvements?" He said: "I'd turn the Gladstone cylinders upside down, and put the valves on top, drive through a rocking shaft, and use a long valve travel."

I told him I was going to fit a superheater and a mechanical lubricator, and he nodded approval, adding, "and don't forget an inspirator so that you can feed the boiler while she is standing still"—this with a chuckle.

After two or three more comments the dream faded out. Anyway it was so vivid that when I awoke in the morning I was not only able to remember it but I made some notes of what the old boy had said. I must confess to a cold shiver running down my back when I checked off and found that the front axle *actually did* cross the line of the valve spindles of a pair of Gladstone cylinders; that Billy *would* have held the blobs and gadgets close to his eyes when examin-

ing them, as he was shortsighted; and that he always called an injector an "inspirator."

By the way, when at the Paris Exhibition of 1889, he was informed that his engine *Edward Blount* (Gladstone class) would have got the top award if he had had any means of feeding the boiler while standing still; she had only the usual crosshead pumps. His reply was that his engines were built for *running*, not standing still—hence the chuckle when he spoke of the "inspirator."

I'm not interested in Spiritualism but certain well-known folk who are are quite convinced that the spirit of the great locomotive engineer actually did come from the Great Beyond that night to advise me on the job.

### Recommendations adopted

I had a set of *Petrolea* cylinder castings, so I machined them up—making the portface parallel to the cylinder bores—and fitted them to the frames with the steam chest on top. A pair of rocking levers were fitted to the back of the motion plate, which enabled the link motion to be erected horizontally, the die blocks being mounted on the bottom pins in the rocking levers while the upper ends were coupled to the valve spindles by short links.

The mechanical lubricator was fitted in the usual position behind the front beam, and to drive it I fitted another rocking lever on the front side of the motion plate, connecting the upper end to one of the valve spindle forks by a link while the lower end was connected to the ratchet lever of the mechanical lubricator by the usual rod. The oil is fed direct into the steam chest via an extra check-valve in the front wall.

The boiler is  $3\frac{1}{2}$  in. dia. with a firebox having a grate area of 4 in.  $\times$  2 in. There are nine  $\frac{3}{8}$  in. tubes and two  $\frac{7}{8}$  in. superheater flues with  $\frac{1}{4}$  in. elements. It is fed by a crosshead pump on the right-hand side which has a ram only  $\frac{1}{8}$  in. dia. ("scale" size) but easily maintains water level. Billy's recommended "inspirator" feeds into the left-hand clack; you can see it under the footstep in one of the pictures, both of which were taken by Miss Lorna Procter. Its "vital statistics" are 67-74-78 and will feed the boiler on the run without any appreciable effect on the steam pressure.

The spring-balance safety valves on the dome are exceedingly realistic and behave exactly as in full size. The footplate fittings are about right, too; note the reversing lever. I had to put the steam gauge in the position shown to have it visible from the driving position behind the tender

—by the good rights it should be on the side of the cab.

The Stroudley type of clasp brake is fitted to the driving wheels. At the bottom of the rear hanger is a small cylinder containing a piston like that of an i.c. cylinder. The gudgeon pin projects at each side and is connected to twin brake rods (inside and out), the front ends of these being coupled to the forward hanger.

If air is admitted to the cylinder, the piston is forced outwards, pulling the brake rods and bringing the leading brake block into contact with the tyre. At the same time the reaction on the cylinder head pushes the hanger to which it is attached towards the wheel, and thus presses the rear block against the tyre.

This arrangement did away completely with all the usual beams, pull-rods and other conventional rigging, and worked perfectly on the full-size engines. All it needs on the little one is a supply of compressed air to work it, and when I feel up to a spot of "watchmaking" I'll make the Westinghouse donkey pump and the rest of the job. I originally intended fitting a dummy donkey just for appearance' sake, but somehow I dislike dummy stuff on any engine.

When the full-size engine was first built she had wooden brake blocks on the driving and trailing wheels, which could be actuated by steam or hand. The handle for operating by hand was just inside the cab on the right-hand side. I fitted it, and utilised it for working the pump bypass valve.

### Wheel bite

A working sanding gear is fitted—necessary with a single-wheeler having big cylinders. It isn't the *weight* on the drivers that prevents slipping but the *friction* between the tread of the wheel and the rail head. The Brighton enginemen called it "bite." An eight-wheel-coupled engine will "lose its feet" on an icy or greasy rail despite the weight on the wheels; *per contra*, a single-wheeler handled by a driver who knows his job seldom starts "ballet-dancing" on dry or sanded rails.

The sandboxes are integral with the driving splashers, the idea being to keep the sand dry by the heat from the boiler. Dry sand will run freely through the pipes and valves. The sand valves on the little engine are like plug cocks, but the plugs are parallel and have an opening through them as large as the pipe. They work very well with finely-sifted silver sand.

There is nothing special about the tender, which is of the regular Stroudley type—long and low with inside frames. Billy made them low so that a fireman, for instance, could stand

on top to bring coal forward without risk of head-injuries when passing under bridges. They had to be long to have the coal and water capacity.

I fitted the fancy steps, tool box at the back, outside brake rods (same as full-size) and the rear sandboxes. In the days before continuous brakes were in vogue and when the only braking power was that afforded by the engine and the two brake vans on the train, it was difficult to make an emergency stop. If such was needed, the driver warned the guards by a special whistle signal, and to aid those worthies he opened the valves of the tender sand boxes so that the brakes on the vans had a sanded rail to bite on.

After continuous brakes were adopted, we found a good use for the tender sanders. When backing on to a train at London Bridge or Victoria, they were used to sand the rails between the last set of points and the train. The engine wheels rolled it down, and left a surface like a macadam road on which the driving wheels bit to such good purpose that the single-wheelers started and accelerated their loads as readily as a coupled engine.

### Ablution pail

One item on the tender has amused the few good folk who have seen it, to wit the tiny water-cock under the coal gate, which in full size was used to fill the pail for wetting the coal when it was dusty. I hated being seen with a dirty face so I always had a good wash in a pail of hot water before booking off, and I fitted the little cock in memory. It is to "scale" size and is drilled No 70. It works!

I painted and lined the engine myself in the old Brighton livery—my hands are still steady though I have passed the proverbial three-score-and-ten long since—and as the splashers are made from sheet brass, I simulated the gold lettering by scratching out the name in the yellow paint and shading the letters. The full-size engine had additional black shading, but I didn't fancy it on the little one, so left it out. The corners of the lining were tricky to do, but I managed them with a trimmed-down water colour brush.

The engine steams and pulls in fine style, and when running with a single passenger (equal to about nine coaches) with the lever next to middle, she will do nearly two miles on one firing. The exhaust is barely audible—the only sound is the clicking of the wheels over the rail joints—and that she is actually running, not merely gliding, is indicated solely by the balance weight bobbing in and out of the driving splasher. ■

# SAFETY

## ON THE LINE

**P**UBLIC passenger-hauling on model railways is a vocation and responsibility not to be undertaken lightly. "Safety at any cost" should be your slogan, and people adopting an unmethodical approach to this extremely interesting branch of model engineering will rapidly discover that carelessness and inefficiency just do not pay.

Doing the wrong thing—as in all walks of life—is often the result of inexperience and lack of understanding of actual requirements. No matter how one theorises, practical application of a scheme will usually reveal the need for some modification. Every point discussed in these notes is a modification—the result of several seasons' running experience.

Considering the world-wide interest in the construction of live-steam locomotives to passenger-hauling scales, the amount of published information on actual operation is surprisingly sparse. Sir Arthur Heywood's privately published account of the construction and operation of his 15 in. gauge Duffield line in Derbyshire back in the 1890s is still the most comprehensive manual on the subject, i.e. *Minimum-Gauge Railways*.

### RAILS AND WHEELS

Rails should have as stiff a section as possible to give anti-roll stability to train and trucks. Train wheels—and cars—will follow an undulating track providing sleepers are firm to the ground. Derailments are caused almost entirely by side-rock of the track.

Where the track can be laid on a proper gravel-chipping bed the level can be achieved by tamping and packing as in full-size practice, but when the rails are laid just for the day wooden packings are best utilised.

All wheel flanges of my locomotive and trucks were turned to have a scale depth (just under  $\frac{3}{16}$  in. for  $1\frac{1}{2}$  in. scale), but were very soon re-turned to give double-depth dimension— $\frac{3}{8}$  in.—after the first day's running on a football pitch! (Fig. 1). If the flange radius is made greater than the rail-edge radius there is little extra friction,

even on minimum radius track curves—45 ft for  $7\frac{1}{4}$  in. gauge.

Flat treads on all wheels give a greater contact area and, having tried the wheels with 20 deg. coning, I can assure the advantages of better adhesion and even wear on rail-heads outweigh the theoretical benefits of coning. Unless rails are canted to the coning angle the order should be flat treads every time.

### DRAW-BARS AND LOCKING PINS

Fig. 2 illustrates an effective positive-locking quick-release track joint that requires no spanners to secure. Several forms of rail joint were tried before settling for this type. Rail ends are supported on a common sleeper and locked between two pairs of fish-plates via a wing-nutted locking rod, and the central cross tube brazed to the inner fish-plates ensures even "nip" of the loose rail ends.

To enable the engine to get its head

**ERIC HAWKESWORTH**  
brings home a very important—though sometimes misunderstood—aspect of model railway practice

in the collar when starting a heavy load either forward or reverse an extra spring draw-bar is fitted between the tender and leading passenger truck (Fig. 3). A  $\frac{1}{4}$  in. steel plate "drop" bracket is pivoted to the car frame with a  $\frac{3}{8}$  in. bolt, and the  $\frac{5}{16}$  in. draw-bar is located through a lower hole to bring it into line with the tender hook. Two car valve springs with end cotter caps take the pull or push from the engine before transmitting the strain to the cars.

Unless connections of the chain type are used between all trucks some sort of spring draw-bar, in addition to the usual one between engine and tender, must be fitted to ensure positive starting. A single  $\frac{1}{4}$  in. dia. split pin locks the bar to tender.

The engine to tender draw-bar pin should be safe-tied to prevent accidental withdrawal. I well remember the alarm and despondency caused by seeing the engine shoot away on half throttle—leaving a rather useless driver still seated on the tender.

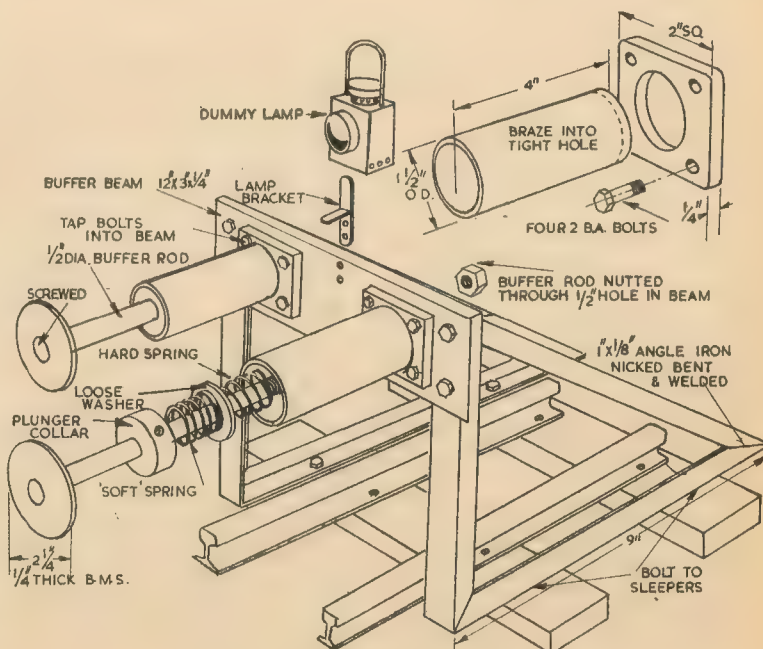
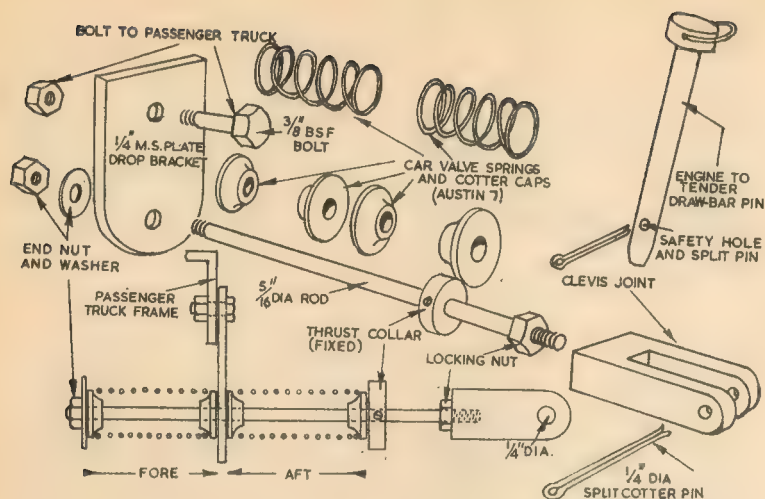


Fig. 4: Working line-end buffer stops



Fortunately, the engine was caught on the opposite side of the continuous track and shut down.

### BRAKES AND BRAKING

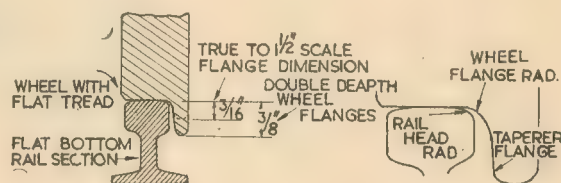
With some eight-hundredweight on the engine and tender wheels, steam braking on the engine and quick-action hand braking on the tender has been ample for coping with all stopping contingencies.

Some form of continuous hand or foot braking on all truck wheels would be a valuable acquisition. Indeed, I am already at work on a scheme. With bogie coaches, the apparatus must be simple and trouble free . . . there just isn't time for finicky adjustments when running for the day at fetes and garden parties.

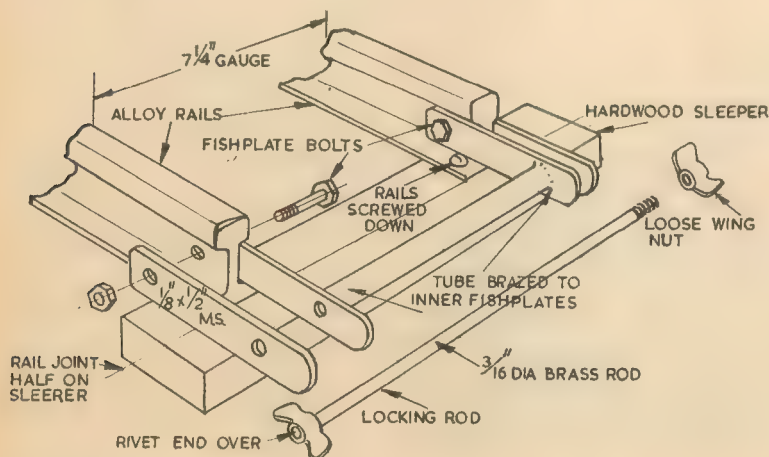
Professional engine drivers often look down their noses at reverse gear stopping—several, in fact, have told me it's bad practice. However,

Above, Fig. 3: The tender leading passenger truck draw-bar

Right, Fig. 1: Safety extra-deep wheel flanges



Below, Fig. 2: A positive-locking quick release rail joint



running on a straight up-and-down track I frequently use this method. If the train speed is judged nicely, closing the regulator and pushing over the reverse lever in good time the engine can be decelerated with a gentle cushion of steam in the cylinders. It's rather like stopping a car using the gears—all the wheels and mechanical parts take the strain. Better than wearing flats on the wheels!

### LINE-END BUFFER STOPS

Useful as well as decorative, the line-end stops act as an insurance against over-run. They also keep small boys from lying head on against the rails to watch the engine approach! The main beam is a quarter plate  $12 \times 3$  mounted on two triangular angle-iron brackets (Fig. 4). The brackets are V-nicked and then bent and welded. (Riveted plates could be substituted for the welding.)

The buffer sockets are 4 in. lengths of  $1\frac{1}{2}$  in. o.d. steel tube brazed into tight holes in the centre of 2 in. squares of quarter plate. Four 2 BA hexagon bolts, tapped into the beam, fasten the sockets in place. The buffer rod,

and heads are made to the dimensions indicated from bright mild steel, and the rods are fitted with plunger collars and two springs. The front spring can be a car valve type—about 90 lb. to compress—but the rear ones must be of tougher section and coil.

The buffer rods pass through a  $\frac{1}{2}$  in. hole in the main beam and have washer and nut behind. Bolt the beam to the angle brackets and the brackets to the sleepers. A dummy end-of-line lamp on a bracket adds a touch of realism.

One should always carry third-party passenger insurance and be covered against boiler explosion risk. Temporary fencing round the track, even if it's only a few stakes secured by ropes, is an effective barrier.

Other modifications to equipment include the substitution of coil springs to car axles in place of the original rubber blocks, and tow bars to car bogies instead of car frame to car frame.

Truly, a little practical experience is worth a boiler full of theory. ■

# RECONDITIONING A MACHINE HACKSAW

By EXACTUS

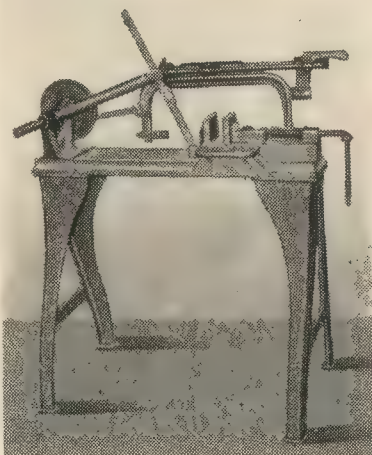
*First of a short series describing the renovation of an old hacksaw machine that had been ravaged by the elements*

**H**ow many years ago the machine hacksaw in Fig. 1 left its place of manufacture, the M.F. Co. Ltd, Millers Falls, USA, is not known, but undoubtedly it has seen, and given, many years of good and faithful service.

It was given to the ME workshop with the thought that a few improvements might give it many more years of service. When a piece of hefty stock material has to be sawn, it is handy to be able to do it in a machine saw, not to count the sweat and energy saved. With this in mind the saw was carefully examined to see what work was involved to give it a new lease of life.

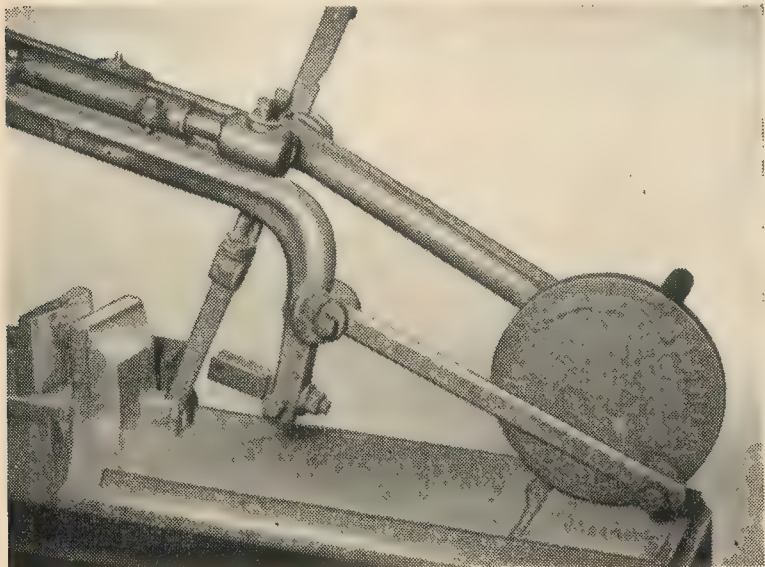
Judging from its appearance it must have been left exposed to the weather or some very damp atmosphere because the guide and slide bars were so badly fitted with rust that their diameter had been reduced by  $\frac{1}{16}$  in. They certainly needed renewing.

The part of the crankshaft that



*Above, Fig. 1: The machine saw before it was reconditioned*

*Below, Fig. 2: Close-up showing connecting rod and crank disc*



extended outside the bearing was in a similar condition, and it was also noted that it had been in contact with a hammer or similar object. This part of the shaft was for the driving pulley, now missing, and was  $\frac{1}{16}$  in. dia.

It was estimated that by reducing it to  $\frac{7}{8}$  in. it would be as good as new and a pulley could be bored to suit.

The part of the shaft that was inside the cast-iron bearing was in good condition owing to the fact that it was still covered by a film of oil. There was a small indentation in the shaft where it had stopped opposite the oil hole, but nothing to worry about.

Sometime during its active career it parted company with its connecting rod, crankpin, and small end pin. It would be interesting to know just exactly what happened to them; perhaps they wore out through long service, though I have doubts about the connecting rod.

## Too slow

Whatever the story behind the mystery I am sure the original connecting rod was more graceful than the old piece of  $\frac{5}{8}$  in. square bar held in position by two old iron bolts (Fig. 2). It was decided that an aluminium casting should replace this old connecting rod and that a ball race that happened to be at hand should be used for the big-end.

The only other part that needed replacing was the screw for the vice. This was apparently ravaged by the weather and was beyond repair.

Cast on the crank disc was the recommended speed for the machine, 45 r.p.m., and this was considered slow for the needs of the workshop. With the use of high-speed machine saw blades that are available today it was decided to double this speed and bring it more into line with present-day machines. A Brooks Cub, running at 1,420 r.p.m., fulfilled this requirement.

This meant that a countershaft would be necessary and this could be neatly accommodated beneath the bed of the machine. It worked out

that using two 2 in. dia. and two 8 in. dia. Picador V-pulleys it would give a crankshaft speed of just under 90 r.p.m. An odd revolution one way or the other will not have any great advantage or disadvantage to this type of machine.

The first problem was how to machine the crankshaft. There were no centres or flat machine faces to work from so I decided that my first job would be to machine a flat surface on the crank disc and use this to work off.

All burrs and high spots on the end of the crankshaft opposite the disc end were removed with a file and then this end of the crankshaft was placed in the three-jaw chuck of the Myford ML7. The fixed steady was placed at the other end to support the shaft, and a test dial indicator used to test the shaft for running true (Fig. 3).

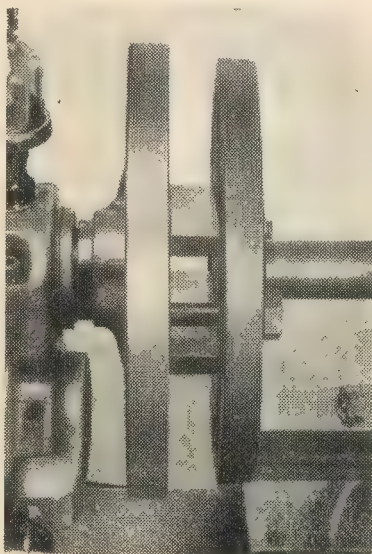
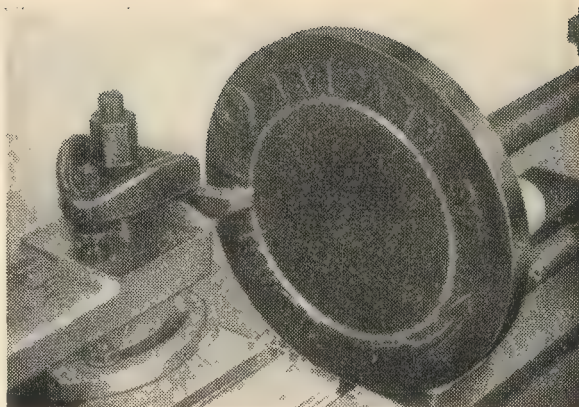
When all was running true a round-nose tool was set in position on the toolpost and the lathe engaged in backgear, using its slowest speed (Fig. 4). The quality of the cast iron was very good and made the machining a very pleasant job.

It will be noticed that a cut was started inside the cast letters and crankpin boss (Fig. 4). This was done so as not to disturb the boss unless absolutely necessary, and as the parallel strips were only 3½ in. long an area 4½ in. dia. would be sufficient to meet the occasion.

When the machining of this face was finished a light cut was taken over the crankpin boss to make sure the new crankpin would sit against a true seat. Next a centre drill with a

Right, Fig. 4:  
*Machining  
the crank disc*

Below, Fig. 5:  
*The crank  
disc bolted on  
parallels to  
the faceplate*



The fixed steady was no longer required so it was removed and the centre in the tailstock taken over. Fig. 6 shows the shaft located on the tailstock centre and the first cut completed.

The steel shaft was the same quality as the cast-iron disc and it completed the crankshaft from the turning point of view.

The shaft was reduced to 7/8 in. dia. and all the pit marks caused by rust, etc., were removed. This diameter was continued along the shaft so as to leave a shoulder 6 in. + 0.003 in. from the crank disc. When the pulley wheel came up against the shoulder the shaft had 0.003 in. float.

This completed the machining of the crankshaft and it was now ready to be put back in its bearings.

● *To be continued*

Fig. 3: *Testing the shaft for  
concentricity with an indicator*

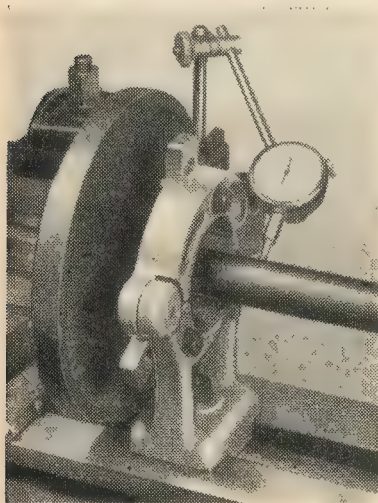


Fig. 6: *Turning the crankshaft*

5/16 in. shank was put into the tailstock chuck and the crank disc centre drilled for any future use. This operation completed, the crankshaft was removed from the lathe and prepared for the next machining operation.

The first thing was to drill two clearing holes on a centre line, 1½ in. from the centre of the disc for two 3/8 in. bolts.

These two bolts held the crankdisc on the parallel strips against the faceplate, as shown in Fig. 5. The fixed steady was used to support the other end of the crankshaft and a similar procedure adopted as in the previous operation in getting the shaft to run concentric.

When all was running true and tightened up the end of the crankshaft was faced and centre drilled. The drill chuck was then removed and a hardened centre inserted in its place.



# POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

## LITTLEJOHN LATHE

**S**IR.—Several articles have recently appeared in *MODEL ENGINEER* concerning detail modifications to the Littlejohn lathe.

While I cannot but agree that the modifications are helpful, I am afraid the wrong impression of the lathe may be created despite the favourable remarks made by the author.

As an engineer who has had responsibility for choosing the Littlejohn in preference to more expensive and more glamourised machines, may I be permitted to make one or two observations on this particular machine?

slideways, mandrel, etc., than to frills and furbelows which, however, can be had as extras for "them as wants." More frequently the craftsman turner will delight in putting his signature on the machine by making a few extras and modifications himself. This being precisely what the author has done and reported.

In hearing of such things many people tend to think that there must be some deficiencies in the lathe itself and nothing could, in this case, be more fallacious, as I have endeavoured to point out.

The mandrel will pass a 1 in. bar right through with ease and for such operations as making bushes from the

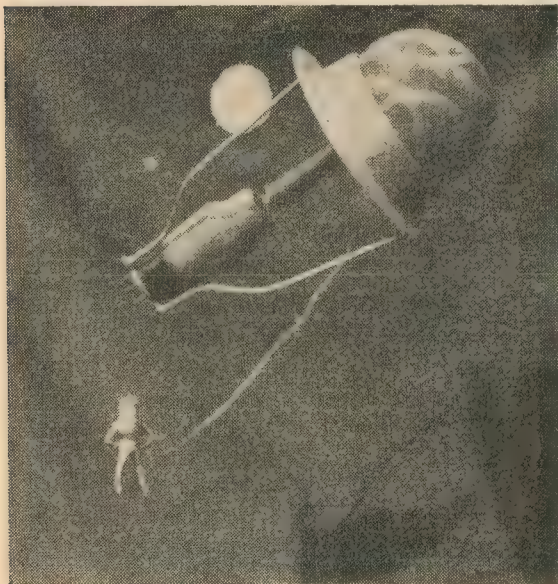
points to be obtained instantly.

Again, the system of "pick-off" gears used for the change wheels makes the lathe a delight to use for screw cutting even if it is not fitted with a quick change box. (Such a box is obtainable as an extra.) Likewise, the square threaded mandrel nose obviates any reluctance on the point of chucks or back plate to come unstuck and materially assists in keeping these components running true after considerable use.

How many other lathes of the same price are equipped with power cross feed? How many other lathes of the same price owe nothing in design and looks to the American South Bend machine? How many lathes of the same price, British-conceived with apology to no one, perform like an expensive toolroom machine and are as versatile as the good old Littlejohn?

I must, of course, make the usual disclaimer about having no connection with the Raglan Engineering Co. Ltd. Slough, Bucks.

A. J. S. BAKER.



*This unique shot of a spaceman coasting in mid-gear was secured at extreme personal inconvenience by M. K. Huggard, using his 72 in. cardboard reflector*

In the first place the Littlejohn is produced by a small concern, by a team of craftsmen directly and technically headed by the managing director, who is also chief designer. This gentleman is extremely practical and understands only too well that while chromium plated knobs and streamlined belt guards may sell a few machines, these things cost money and do not help the turner.

It is also realised that many people who buy a Littlejohn will have to watch the pennies, and for this reason more importance is given to the heart and soul of the machine, i.e. the bed,

bar or machining long shafts, this facility is invaluable. The ability of the hardened steel slides on the bed to resist wear is simply amazing, even under the most appalling conditions of misuse due to using the lathe as a grinding machine. Damage is negligible and there is always the comforting thought that if wear takes place the slides can be renewed cheaply and quickly.

Another happy feature is the use of the lathe as a test rig to run performance curves on pumps, etc. The stepless speed variations over a very wide range enable the appropriate

## ONE OF OURS?

**S**IR.—While the subject of bleeps and satellites is so much to the fore just now, I may say that recently, while combing the Universe with my home-made cardboard parabolic reflector (72 in.), I was fortunate enough to secure the accompanying shot with my No 2 Folding Blackie, fitted with long-range telephoto lens.

It seems to me to be a spaceship, but I don't know whether the spaceman is in trouble or merely taking an evening sput.

What puzzles me is the shadow in the background. This may be simply that cast by the object on some gaseous nebula, like tobacco smoke, for there are, no doubt, phenomena in space unfamiliar to me.

Co. Wicklow. M. K. HUGGARD.

## MODEL SUBMARINES

**S**IR.—I hasten to assure Mr V. B. Harrison [Postbag, October 17] that one need not go as far as Germany to find working models of submarines. Several excellent models, capable of diving and surfacing under radio or time control, have been constructed by amateurs in this country, though I do not know of any commercially-made examples, apart from relatively

cheap toys. If I remember rightly, Major A. G. Bates described a working model submarine some years before the war; within the last ten years an electrically-driven model has been demonstrated by (I believe) Mr Hinton, at regattas in the North Midlands.

One of the best examples I have seen in action is that constructed by Mr Emery, of the Bedford SME, and illustrated herewith. It is radio-controlled, and is probably unique in having a dual propulsion unit like the full-sized prototype, that is, diesel engine for surface cruising and electric motor for running submerged. The last time I saw it, at Wicksteed Park, Kettering, Mr Emery was working on a "schnorkel" (underwater breathing tube) with a very ingenious device for automatically controlling immersed depth when this was in use; it would be interesting to learn how successfully this functions in practice. Model submarines are interesting and offer great scope for experiment.

There is no insuperable difficulty in designing a fully functional model submarine—hydrofoils, ballast tanks, torpedo tubes—the lot—if one is prepared to take the trouble to do so; but one reason why this type of craft is never likely to be a top favourite is that most of us like to see our boats in action—not to strain our eyes for the glimpse of a periscope while the rest of the outfit is hidden beneath the waves!

London, W1. EDGAR T. WESTBURY.

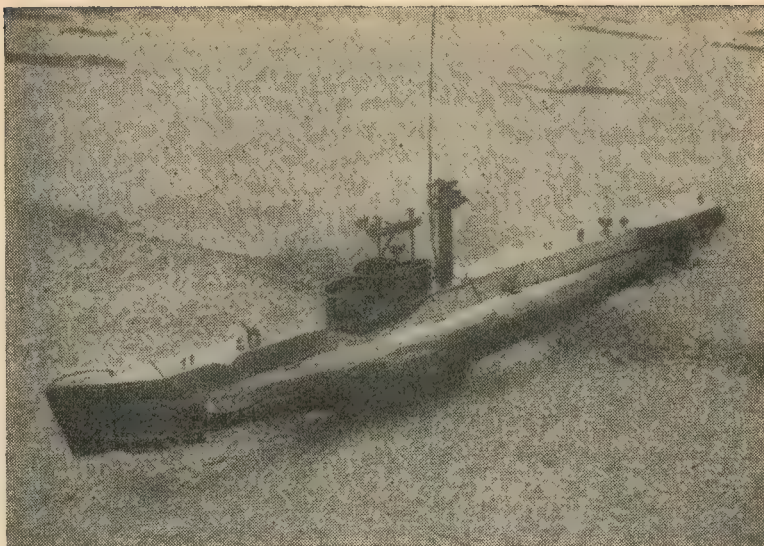
## VALVE EVENTS ANOMALY

SIR,—So far as my personal taste is concerned Mr Maskelyne's delightful series is the high spot of the present ME and I believe that I am far from being alone; I sincerely trust that it will be possible, as recently suggested in your columns, eventually to publish this series in book form for the benefit of present and future admirers of the steam locomotive.

Re-reading No 39, the GWR Dean goods 0-6-0, I was struck by the data relating to the valve gear valve and portface dimensions. There is something distinctly wrong somewhere here.

Take first the valve and portface dimensions. My sketch shows these as given in the article. It will be noted that the valve is given as being  $11\frac{3}{8}$  in. long and having  $1\frac{1}{16}$  in. lap, whereas the length over the outer edges of the ports is  $9\frac{1}{2}$  in., which with  $1\frac{1}{16}$  in. lap added at each end gives a valve length of  $11\frac{3}{8}$  in. If the overall length of the valve is right, then the lap would be only  $\frac{1}{8}$  in. Probably the  $\frac{3}{8}$  in. is an error for  $\frac{1}{8}$  in.

This, however, is far from being the end of the story.



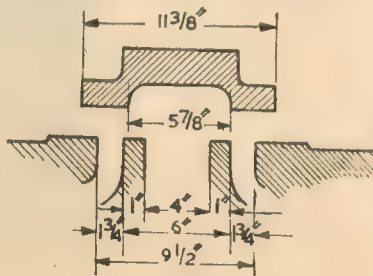
The model submarine constructed by Mr Emery, of Bedford SME. See the letter from Mr E. T. Westbury

Travel in full-gear is given as  $4\frac{1}{2}$  in. and in mid-gear as  $3\frac{1}{4}$  in. and I entertain the strongest doubts about this latter figure. Supposing, however, that it is correct, then with the crank on either dead-centre, the valve will have moved,  $1\frac{1}{16}$  in. from its central position and, as it has  $1\frac{1}{16}$  in. lap, the port will be open  $\frac{3}{8}$  in. Surely a "lead" to rejoice the hearts of the most rabid "ample lead" fans!

Again the lead in full-gear is estimated at "about  $\frac{1}{8}$  in." Surely this too must be an error?

A lead of  $\frac{1}{8}$  in. in full-gear is something quite fantastic, as for that matter is a lead of  $\frac{3}{8}$  in. in mid-gear. Without additional data such as the angular setting and throw of the eccentrics, length of eccentric rods and centres of link pins it is not possible to work out the cut-off in mid-gear (or anywhere else) but with a  $\frac{3}{8}$  in. lead it would obviously be very late.

In passing, Stroudley's *Gladstone* had a full-gear lead of  $\frac{1}{16}$  in. The lap of his valves was  $\frac{3}{8}$  in. so that the lead



he adopted was very closely proportionate to that adopted by Churchward for his Walschaert's gear engines:  $\frac{1}{8}$  in. for  $1\frac{3}{8}$  in. lap, Stroudley  $1/14$  lap, Churchward  $1/13$  lap. (Authority for the *Gladstone* figures: B. K. Clarke, *The Steam Engine*, Vol. 4, p. 576.)

Perhaps Mr Maskelyne could find time to look into these startling and contradictory figures and elucidate matters.

Despite its apparent simplicity I have always regarded Stephenson's gear as one of the most difficult gears to understand thoroughly and from which to obtain optimum results. It is simple enough to make it function "satisfactorily" but quite a different pair of shoes to make it function efficiently throughout its range in either direction; it seems to be little realised what a profound effect on such functioning is produced by the suspension and reversing arrangements.

The complacent attitude, "It works, so what?" always seems to me to be the very negation of the true engineering spirit.

"It works" is a fine and very necessary starting point; with far too many it is also a terminus. The true engineer always has ambitions to make it "work more efficiently." He may not always succeed but without such ambition there would be no progress. Always with us are the troglodytes with their heads buried in the sands of the past.

Rustington,  
W. Sussex.

K. N. HARRIS.

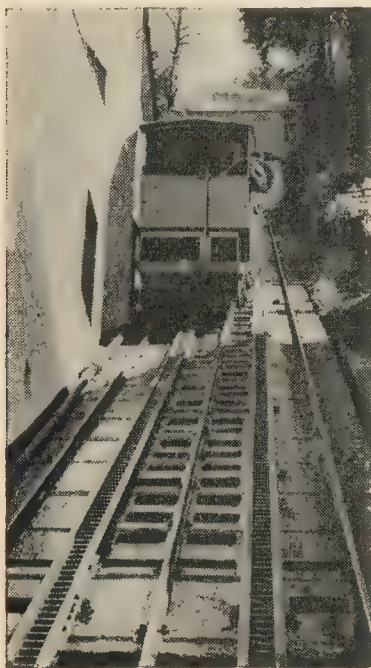


Left: Britain's oldest industrial locomotive built by Hawthorn and Co., of Leith, in 1861, is to be preserved in a locomotive museum in Leith. For nearly 100 years it has worked the line connecting Howe Bridge with Bedford Basin, Leigh, Lancs. Three societies—the Stephenson Locomotive, the Manchester Locomotive and the Edinburgh SME—have jointly arranged for its preservation

## Pictures

*Readers of Model Engineer are a shutter-happy crowd. Here is a selection of the latest subjects at which they have aimed their lenses*

*This rack railway which Frank Bunce encountered in Salzburg is operated by water power. Large capacity tanks fitted to the two cars, working see-saw fashion, are filled with water at the top station and emptied when they reach the bottom*



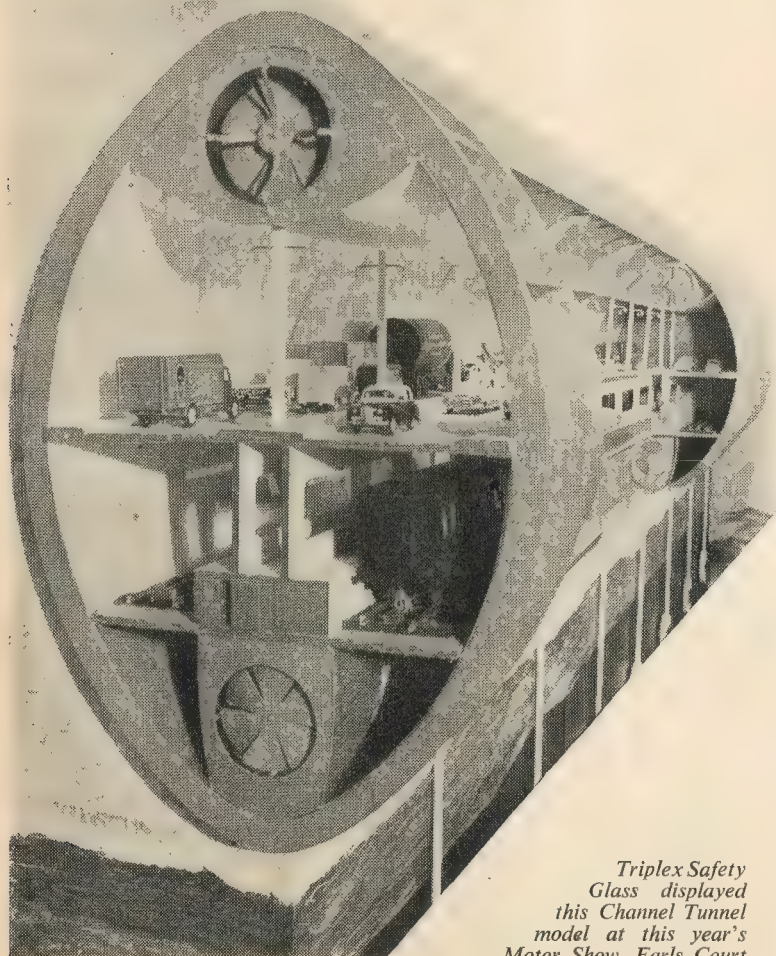
*C. T. Steeb, of San Diego, California, took this shot of a stuffed bear up a signal post, which is located at the Pony Express Museum*





Frank D. Woodall, sending this picture of two lonely-looking road engines, wants to know when Lancashire or the West Riding of Yorkshire can expect a traction engine rally

*from our readers...*



*Triplex Safety Glass displayed this Channel Tunnel model at this year's Motor Show, Earls Court*

## GAS ENGINE continued from page 634

steel plate may be used, and after cutting roughly to shape it may be set up in the four-jaw chuck to machine the pintles which pivot in the arms of the control fork.

These should first be turned over-size and a very fine centre drilled in each of them, so that the collar can be set between centres, or one end held in the self-centring chuck while the other is finally machined, thus ensuring their correct alignment. The collar should be a sliding fit in the groove of the sleeve, and to ensure long wearing properties, it should be case-hardened and polished.

The two fork arms and the control lever call for little comment, as they are simple to make, either by cutting from solid  $\frac{5}{16}$  in.  $\times$   $\frac{1}{4}$  in. mild steel bar or by brazing the bosses into  $\frac{5}{16}$  in.  $\times$   $\frac{1}{8}$  in. bar. The eyes should be a tight push fit on the control shaft, to which they are finally pinned when their position is adjusted. To ensure that the two fork arms are drilled to exactly the same centre distance, they may be fitted back to back on the shaft and one hole jigged from the other.

To transmit the motion of the governor gear conveniently to the carburettor on the other side of the engine, the control shaft is fitted to a bearing member bolted to the underside of the cylinder head by the two bottom studs, which are suitably lengthened for this purpose. This part can also be built up or machined from solid if desired. To ensure that the two bores of the bearing are in line, it is advisable to mark out and centre-drill the bosses at each end, then drill them from the lathe chuck with a short, stiff No 15 drill, finally running a  $\frac{3}{16}$  in. reamer through both holes.

The governor assembly should be in reasonably good balance to avoid vibration when running. This should be checked by assembling the rotating parts on a short mandrel and rolling this on accurately levelled strips. If it is found to stop only in one position every time, it is obviously out of balance, and this can be corrected by removing metal on the heavy side.

The yoke is the likeliest part to be out of balance and also the easiest part to correct unobtrusively, assuming that other parts are truly machined. The method of checking applies only to *static* balance, but should be sufficiently accurate for practical purposes; *dynamic* balancing is a more complicated matter, but is only important when the rotating parts are distributed over a substantial axial length, and run at very high speed.

● *To be concluded*

MODEL ENGINEER



# A ship modeller's diary

No ship model society can afford to ignore any chance of participating in an exhibition.

The Thames Group Marine Modelling Society, for example, has its headquarters in Gravesend, Kent. Its members come from both sides of the river and when Grays, Essex, decided to hold an Ideal Home Exhibition the alert secretary of the group, Mr Pollard, seized on the chance.

Two local members, Messrs Cox and Peterson, got busy with some plaster board and made a four-shelf stand excellently suited to models and easy on the finances. Most of the models were power boats and evoked much interest, especially that of Mr Peterson's decorative model in scrap brass. As I attended within an hour of opening I do not know what result came from new members.

A popular feature was the tape recorder. This allowed visitors to hear themselves criticising the exhibits. Mostly they were unaware that their voices were being recorded.

## Realism versus craft

Mention of Mr Peterson's model in brass reminds me of that question which continually crops up; when does a ship model become an art form? The French prisoners-of-war came near to craftsmanship in bone, but most of them relieved the bone hull with black wales or brass guns about the decks or even vegetable cordage aloft.

The 17th and 18th century dockyard models saved themselves by reason of using two or more woods usually of contrasting colours. Also there were guns fitted because the purpose of the dockyard models was to offer a three-dimensional demonstration of a projected ship to those interested in fighting the ship and meeting the cost. The Russian models in ivory offered a fine example of what I mean: of craftsmanship carried out in one material.

In the past we have seen excellent models in Perspex. No matter how good the work they fail to catch the judges' eyes. The explanation is simple. The judges are there to judge ship models and not craftsmanship in a particular material. The modeller could easily have displayed his craftsmanship in portraying a windmill or

a cathedral. So, too, with Mr Peterson's excellent work in brass.

Many years ago Mr Money broke this rule quite successfully. He offered us a wraithlike ship, *The Flying Dutchman*. It was a definite ship, but it was ghost-like. It was correct to period and rigging, but the judges kept the award to the diploma standard.

The model was made from Perspex—hull, spars and sails. Moreover, it was a good model, a ship model.

## Liverpool Nautical Research Society

Merseyside, its ships and its ports, is home to me. It was there I founded

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By JASON

---

the first ship model society. Naturally I have a warm corner in my heart for the Liverpool Nautical Research Society but I am disappointed that there is not any modelling society on Merseyside now.

The LNRS have much in their syllabus which is of great interest to ship modellers and I'm glad to note that Liverpool will have an opportunity of hearing about "Mayflower," her construction and voyage. The programme is quite vague about whether this is the Tudor *Mayflower* or the current *Mayflower II*. The name of the lecturer is not mentioned.

Either of these subjects would be interesting but at the National Maritime Museum in Greenwich there is not a scrap of doubt. Commander Alan Villiers, D.S.C., F.R.G.S. will have delivered his lecture on the New *Mayflower* Voyage in October. This will be of interest to all seamen, ship modellers and shiplovers.

Luckily this will eventually reach a wider audience via the *Mariner's Mirror*.

## The Pamir

The loss of this fine ship will evoke many expressions of sympathy throughout the world. I remember her on her maiden voyage to the west coast of South America. To us at that time, more than half a century ago, she was just another German P Liner. Moreover, they were the only

ships referred to as liners, always, of course, prefixed with the P. Their crews were young, somewhat aloof and well aware that their ships were the most favoured on the coast.

No P ship was ever short of lighters or cargo. Surf days and fiestas effected them least of all the ships in the bays. Like all cadet ships the *Pamir* was fitted with wireless else we might never have heard about her end through the pitifully few survivors.

Strange, is it not, that the last of the clippers comes to rest at Greenwich and the last of the windjammers in the North Atlantic both within a year of each other.

## Bromley, Kent

A long letter from that fine Bromley modeller A. S. Randall outlines a definite purpose in modelling. He will be remembered for his fine scenic miniature model of the *Martinet* discharging coal alongside a wharf at low tide.

Mr Randall has turned his attention to open boats in the Draper technique. He writes: "At the moment I am engaged in preparing various small tools required in the building of open boats." (Note that well, you beginners). He goes on that he has a preference for Admiralty and Royal barges. Moreover, he deplores the fact that no one in the Bromley society shares his interests.

Well, Mr Randall, I've heard that one before during the last quarter of a century. The real cement in any society is surely the intelligence displayed in tackling any problem which is of great interest to the onlooker as well as to the solver.

It would appear from Mr Randall's letter that Bromley membership is mostly of shiplovers. That could be said of any society; Birmingham, Sheffield, Hammersmith even South London. These and others have complained from time to time that everybody does not make models.

What does it matter? People take part in discussions; they'll attempt a small piece of research; they'll criticise; maybe they're artists or can manage a piece of wood "just what is wanted."

Has Mr Randall tried taking someone under his wing? Who knows? It might be worth while!

## The Northerners

I hope to be in Manchester the first week in December to meet Mr P. Symond during my visit to Middleton. It is hoped to lay foundations so that those in the north can get together with those of the south. There is also the question of the Banners. But more of this anon. ■

# CLUB NEWS

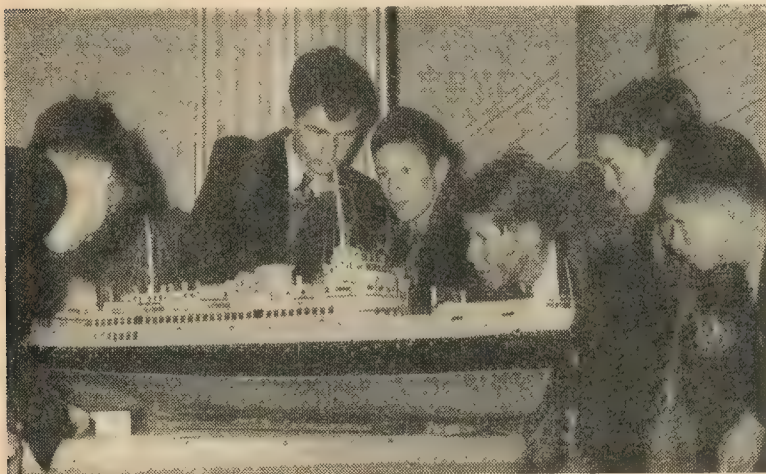
EDITED BY THE CLUBMAN

**S**ATELLITE has long been a familiar word to members of Altrincham Power Boat and Car Club, but the boat of that name, an old stager among power craft, was none too happy on its orbit at the club's annual regatta on Lindow Common. In the same event, the race for 15 c.c. boats, *Nike* took off like a moon rocket, only to stall at an altitude of about four feet. She landed right way up without finishing the course.

Altrincham had the only fine day in a week. The water was a little ruffled but general conditions were favourable. While the speed of the Class C hydroplanes, about a dozen of which competed, fell below the competitors' usual standard, J. W. Jones's *Mambo*, a home entry, achieved 50 m.p.h., with J. Tetley's

event as Waterton of the St Albans club had brought his new craft *Tally Ho*, which was reported to be very fast. Beautifully finished she certainly is; but after a couple of fast laps she stopped, and the first place went to Tomkinson of the home club with a speed of 46.0. Innes, of Altrincham, gained second at 39.8 with his split single.

As usual, there was a large number of entries for the steering competition. Strangely, only one competitor failed to score over a course of 90 yd. Turner, of Altrincham, who made nine, was quickly followed by Oldfield with the same total. No one else could reach the leaders—though Innes came as near as seven—and so they ran off for first and second place. Turner won.



This radio-controlled model of the cross-Channel steamer *FALAISE* attracts the interest of local children at the recent Aberdeen model engineer exhibition. It was built by Mr Gordon Harvey, an Aberdeen Post Office engineer

Pat from Huddersfield second at 42.6. Colin Stanworth's *Spur*, run by proxy, failed to complete the course.

Of several Class D boats which put up quite a good show, the fastest was Oldfield's, another Huddersfield entry, at 26 m.p.h. Speeds rose in the 15 c.c. class and Sutton's *Nike* finished an exciting run in 16.85 sec., or 64.6 m.p.h., Dalziel's *Niadd* from Bournville coming second at 56. The home boats were disappointing.

Much was expected in the 30 c.c.

Mrs English distributed the prizes. "Perhaps the biggest prize," writes secretary D. Innes from 122 Downham Crescent, Prestwich, "should go to those two power boat widows, Mrs Innes and Mrs Westmoreland, who provided hot tea when it was most needed."

Here are the results: Class C, 500 yd, J. W. Jones, *Mambo* 20.9 sec., 50 m.p.h.; J. Tetley, *Pat* 23.9 sec., 42.6 m.p.h. Class B, 500 yd, Sutton, *Nike* 16.85 sec., 64.6 m.p.h.; Dalziel, *Niadd* 18.0 sec., 56.7 m.p.h. Class A,

## ME DIARY

**November 7** Eltham and District L.S. Petrolia by G. Sheed, Beehive, 8 p.m.  
**November 8** Shrewsbury and District SMEE biennial exhibition, Technical College, Shrewsbury, 7 p.m., November 9, 2.30 p.m.

Malden SME, Bits and Pieces. Thames Shiplovers, Building Cutty Sark model, H. G. Harrison, Oddi's Restaurant, Coptic Street, London, WC 2, 7 p.m.

**November 9** Acton MES first exhibition, Baptist Church Hall, Church Road, Acton, London, W3, 11 a.m.-8 p.m.

Glasgow SME coloured slides, R. Kerr (Kirkintilloch SMC).

**November 10** IRCMS at Kingsley Hotel, London.

**November 13** Birmingham SME auction sale, Crown Hotel.

Bristol SMEE, Ball Bearings, Folk House, 7.30 p.m.

**November 14** Hull SME junk sale.

**November 16** SMEE "Inspection Tests on Small Lathes," Col. Marchmont. Nomination day. Pepys House, Westminster, 2.30 p.m.

**November 17** MRCA at Boscombe (postponed from November 3).

500 yd, Tomkinson, *Rene* 22.1 sec., 46.0 m.p.h. Innes, *Twin Pots* 25.85 sec., 39.8 m.p.h. Steering competition, Turner, 3 + 1 + 5, 9 pt + 3 run off; Oldfield, 3 + 5 + 1, 9 pt + 1 run off.

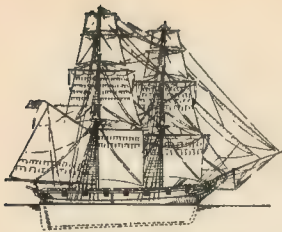
## THE NEW TT SCALE

There is a growing interest among Britain's model railway men in the new TT scale. How the trade has responded could be seen from the Model Railway Hobby Show held at Central Hall, Westminster. Between the second of these shows and the third, TT established itself in Britain firmly enough for the trade to appreciate its great possibilities in an age of small houses and impossible lofts.

Besides occupying a quarter less space than a OO layout, a TT railway lends itself very pleasantly to scenic work—which possibly accounts for the attention paid to it in South Africa and other countries where houses are roomier.

The use of scenery was another trend which the show clearly defined, and I was not surprised to see a crowd in front of a stand where discarded newspapers were being converted, with glue and ballast, into a varied landscape. Here, too, the trade is supplying all kinds of important items, such as trees, tree-making kits, and "old smokey brickwork."

Add to that the electrical control units, which are showing a big advance, and it will be seen that the model railway trade is no longer as cautiously conservative as some of us used to say it was! From this point of view the exhibition was encouraging but surely it should be presented purely as a trade show?



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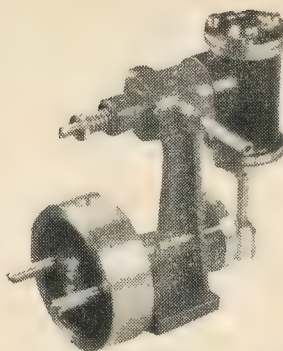
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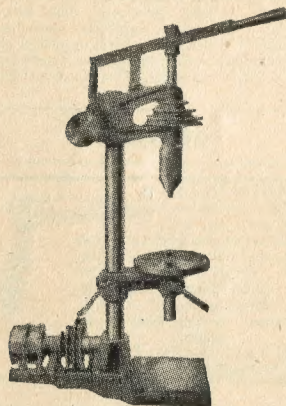
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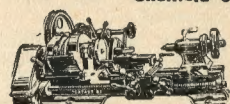
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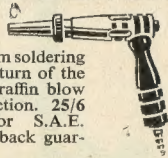
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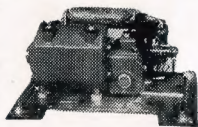


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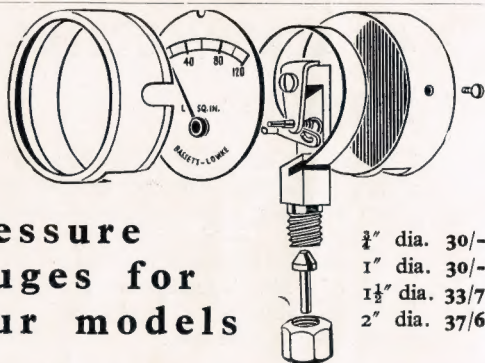
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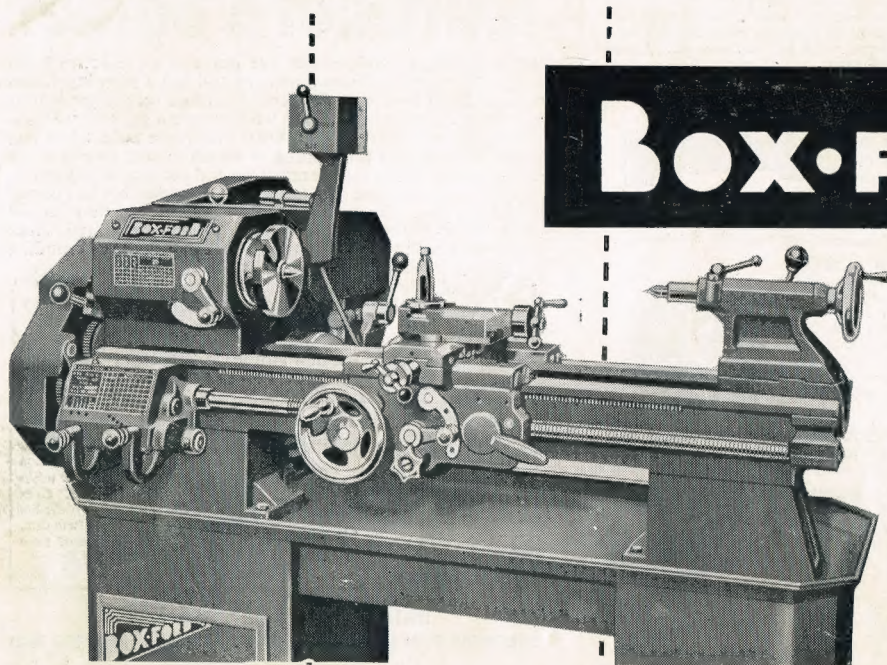
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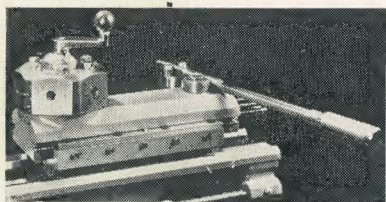
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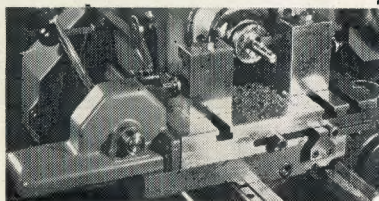


### MODEL 'A'

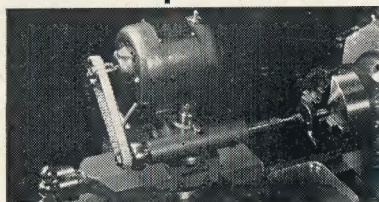
★ Six-station  
Turret Head  
for bed  
mounting



★ Cut-off slide for use  
in conjunction with  
turret head



★ Tool Post  
Grinder



## 4½" SCREWCUTTING LATHE

This lathe is especially suitable for tool rooms, workshops, light manufacturing plants producing small components and for apprentice training schools. The 16 spindle speeds provide for a wide variety of needs. The accessories illustrated give increased production facilities for special jobs.

|                   |            |
|-------------------|------------|
| Height of centres | ... 4½"    |
| Between centres   | 22" or 28" |
| Number of speeds  | ... 16     |
| Range of speeds   | ... 40     |

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22" CENTRES  
PRICE  
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